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S. P. E. E. CONVENTION.

Rooms.

Dormitories and Private Houses.

It is expected that many members who are not accompanied by their wives will find it convenient to room at the "Quadrangle"—University dormitory for men. At least twenty-five single rooms and a hundred double rooms will be available. In each room there is a lavatory with hot and cold running water, and a telephone connected with the city switchboard. Double rooms have two single beds. There are no private bath rooms. General toilet rooms are equipped with showers. There is a commodious lounge for the use of guests. The Quadrangle is about ten minutes walk from the buildings where the meetings will be held. A charge of $1.00 per day for each person will be made for rooms in the dormitory.

For men accompanied by their wives at least one of the annexes to the women's dormitory will be available. Charges for rooms will be $1.00 per day for each person.

Rooms in private houses will also be available at reasonable rates.

Reservations for rooms in the Quadrangle, women's dormitory annex, or private houses, should be made through the chairman of the housing committee. Address R. B. Kittredge, 630 S. Governor St., Iowa City, Iowa. It is requested that each member making a reservation for a room in the Quadrangle state whether or not he is willing to share a double room with another member.

Hotels.

Hotel accommodations in Iowa City are limited and those members who prefer to room at hotels are urged to make their reservations early and *to make them directly with the hotel.* The leading hotels, with their room rates, are as follows:

Hotel Jefferson, Washington and Dubuque Sts.

85 rooms.

35 rooms probably available.

Rooms for one person. Without bath, $1.50, $2.00. With bath, $3.00.

Rooms for two persons. Without bath, $2.50, $3.00. With bath, $5.00.

Of the rooms for two persons, eight of those with bath have twin beds. Each of the others has one double bed.

Burkley Hotel, Washington and Capitol Sts.

65 rooms.

30 to 35 rooms probably available.

Rooms for one person. Without bath, $1.25, $1.50. With bath, $2.00, $2.25.

Rooms for two persons. Without bath, $2.50. With bath, $3.00, $3.50.

Each of the rooms for two persons has one double bed.

Hotel Washington, Washington and Gilbert Sts.

45 rooms.

20 rooms probably available.

Rooms for one person. Without bath, $1.50. With bath, $2.50.

Rooms for two persons. Without bath, $3.00. With bath, $4.00.

About half of the rooms for two persons have twin beds. Each of the others has one double bed.

Meals.

Meals may be had at reasonable rates at a number of conveniently located places. Of the hotels only the Jefferson serves meals. A canteen, for the service of light lunches, will be open at the Quadrangle. There is a cafeteria in the Memorial Union open to men and women.

Camping.

Members who come by automobile and desire to camp will find excellent facilities in The City Park, with water and campstoves available. No charge is made for camp sites. The Park is about a mile from the meeting place.

A STUDY OF ENGINEERING CURRICULA.

BY WALTON C. JOHN

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Bureau of Education, United States Department of the Interior.

The detailed study of the entrance requirements and major curricula of engineering colleges in the United States, which has been made by the Bureau of Education, constitutes one of the most noteworthy contributions to the Society's general investigation. The first installment which appears below deals with the subjects of entrance requirements and of requirements for graduation in civil engineering. The treatment of other principal curricula will appear in later issues and the entire material will be assembled in one of the Bulletins to be issued by the Board of Investigation and Coördination. On behalf of the Society the Board expresses its great appreciation to the Commissioner of Education and to Dr. John for this exceptional piece of coöperation.

INTRODUCTION.

The majority of modern scientific studies begin from the standpoint of the category of quantity, and this is true of many of the studies now being undertaken by the Society for the Promotion of Engineering Education.

Under given conditions it may be shown that the lengthening of a course of study or the expansion of a curriculum may make possible marked improvement in the quality of education, and on the other hand we have examples indicating that reductions may be made in total or specific requirements, thus making possible under the circumstances more efficient educational work. Thus it appears that the quantitative and qualitative aspects of the matter cannot readily be disassociated.

This study deals with both entrance and graduation re-

quirements from the standpoint of specific subjects and general requirements. The relation of these subjects to the entire period of instruction under direct or indirect control of the college of engineering, or for a period of 8 years is also considered. Entrance requirements are discussed from the standpoint of high school units; graduation requirements from the standpoint of semester hour credits. The requirements for the 8 year period are based on the average per cent of unit credit and semester hour credit specified.

The data for each subject or requirement are finally exhibited in terms of the modal, minimum, maximum and median figures.

It is therefore hoped that the facts thus organized may assist the curriculum maker in arriving at necessary readjustments, whether by lengthening or shortening courses of study or by improving their coördination or by making more logical their sequences.

Ninety-two colleges and schools of engineering in the United States are considered in this investigation. Of these 60 are under public control and 32 under private control. This list of schools may be found on pages 523, 524 and 525.

The analysis of the entrance requirements includes all institutions of this list. In the study of graduation requirements in civil engineering it has been found necessary to omit a few institutions whose data cannot readily be made to correspond with the data of the other schools. This explains the omission of the University of North Carolina, the Municipal University of Akron, and the University of Cincinnati. The curricula of these institutions are organized on the cooperative basis. Both Rensselaer Polytechnic Institute and Worcester Polytechnic Institute are not included at this time because of the difficulty in reducing their requirements to semester hour credits. Connecticut Agricultural College, University of New Hampshire, and Stevens Institute of Technology do not offer curricula in civil engineering and are therefore omitted. The three year courses of study in engineering at Columbia University are not included because they are largely graduate in character.

Several colleges operate on a quarterly basis. In these cases it has been necessary to reduce term hours to semester hours.

In most cases the fundamental data of this report have been checked by the Deans or Registrars of the several schools. In some of the cases where verification was not obtainable the writer was able to include the information desired because of the clear statements of the catalogues.

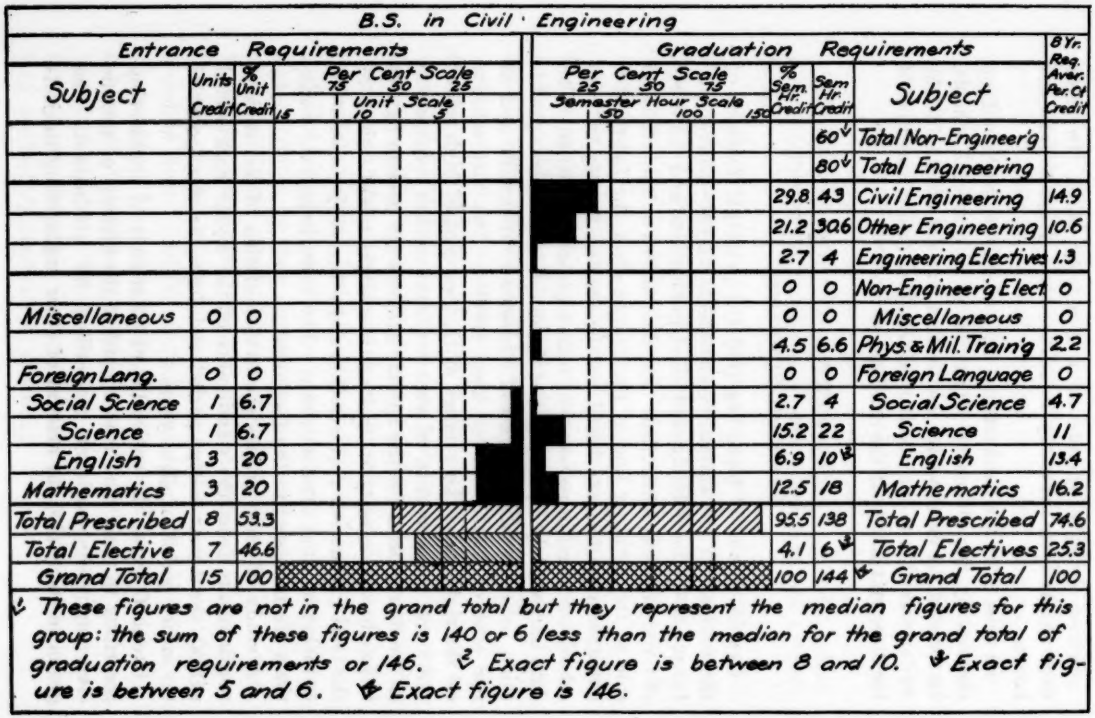
PART I.

Graphical Summaries.

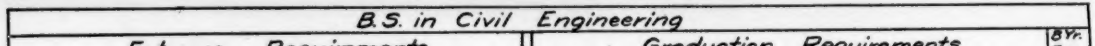
Graphs *A* and *B* bring together the principal features of the analysis of the several requirements in two general pictures, one of the publicly controlled institutions and the other of those privately controlled. The data shown on the left-hand side of the dividing line of the graphs show the figures for entrance requirements based on the median figures in high school units and in per cent. of total high school credits. The data immediately on the right of the dividing line show graduation requirements in terms of semester hour credits and in per cent of total semester hour credits. The last column on the right gives the average of the per cent of high school units and the per cent. of semester hour credits. Inasmuch as the figures used for the specific subjects are median figures it has been necessary to make a few slight modifications of the total graduation requirements and other subjects in order to make the final sums accurate. The more important variations are indicated in the footnotes.

A study of these graphs shows the relation of the various requirements from the standpoints of the 4-year high school period, the 4-year college period and from the standpoint of the entire period of eight years.

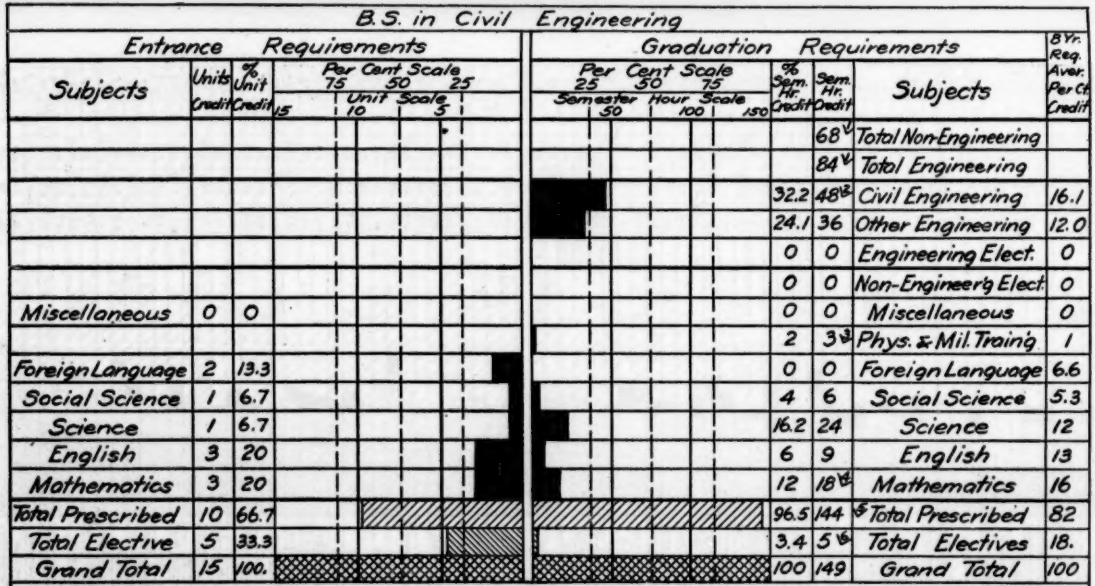
Graph *C* shows the entire list of 83 schools of engineering according to their rank with regard to the amount of specific civil engineering subjects prescribed for graduation. The graph includes also the amount of other engineering subjects


B.S. in Civil Engineering
Entrance Requirements
Graduation Requirements
8 Yr. Req. Aver. Per. Ct Credit
Subject
Units Credit
% Unit Credit
Per Cent Scale 75 50 25
Unit Scale 15 10 5
% Sem. Hr. Credit
Sem. Hr. Credit
Subject
Per Cent Scale 25 50 75
Semester Hour Scale 50 100 150
Miscellaneous 0 0
Foreign Lang. 0 0
Social Science 1 6.7
Science 1 6.7
English 3 20
Mathematics 3 20
Total Prescribed 8 53.3
Total Elective 7 46.6
Grand Total 15 100
60↓ Total Non-Engineer'g
80↓ Total Engineering
29.8 43 Civil Engineering 14.9
21.2 30.6 Other Engineering 10.6
2.7 4 Engineering Electives 1.3
0 0 Non-Engineer'g Elect 0
0 0 Miscellaneous 0
4.5 6.6 Phys. & Mil. Train'g 2.2
0 0 Foreign Language 0
2.7 4 Social Science 4.7
15.2 22 Science 11
6.9 10[2] English 13.4
12.5 18 Mathematics 16.2
95.5 138 Total Prescribed 74.6
4.1 6[3] Total Electives 25.3
100 144[4] Grand Total 100
↓ These figures are not in the grand total but they represent the median figures for this group: the sum of these figures is 140 or 6 less than the median for the grand total of graduation requirements or 146. [2] Exact figure is between 8 and 10. [3] Exact figure is between 5 and 6. [4] Exact figure is 146.

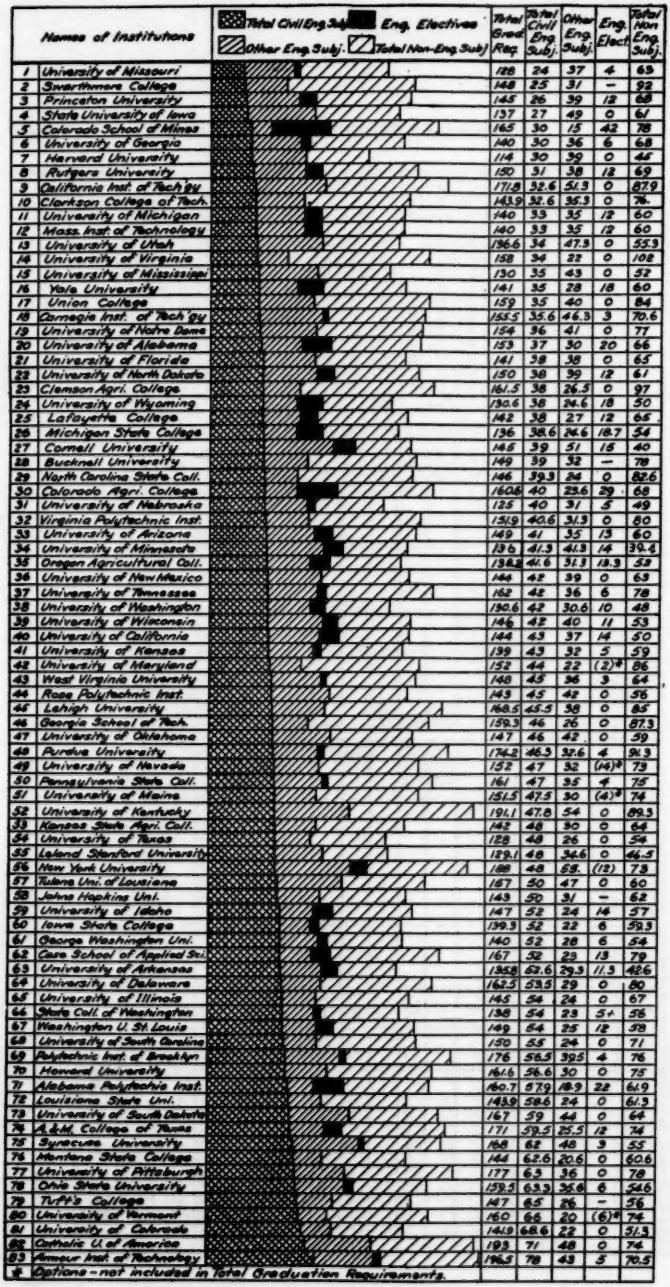
GRAPH A. ANALYSIS OF FOUR-YEAR CIVIL ENGINEERING CURRICULA BASED ON THE MEDIAN FIGURES OF THE REQUIREMENTS OF 55 PUBLICLY CONTROLLED SCHOOLS OF ENGINEERING. 1924–1925.



GRAPH B. ANALYSIS OF FOUR-YEAR CIVIL ENGINEERING CURRICULA BASED ON THE MEDIAN FIGURES OF THE REQUIREMENTS OF 55 PUBLICLY CONTROLLED SCHOOLS OF ENGINEERING. 1924–1925.


B.S. in Civil Engineering
Entrance Requirements
Graduation Requirements
Subjects
Units Credit
% Unit Credit
Per Cent Scale 75 50 25
Unit Scale 15 10 5
Per Cent Scale 25 50 75
Semester Hour Scale 50 100 150
% Sem. Hr. Credit
Sem. Hr. Credit
Subjects
8 Yr. Req. Aver. Per Ct Credit
Miscellaneous 0 0
Foreign Language 2 13.3
Social Science 1 6.7
Science 1 6.7
English 3 20
Mathematics 3 20
Total Prescribed 10 66.7
Total Elective 5 33.3
Grand Total 15 100.
68↓ Total Non-Engineering
84↓ Total Engineering
32.2 48↓2 Civil Engineering 16.1
24.1 36 Other Engineering 12.0
0 0 Engineering Elect. 0
0 0 Non-Engineer'g Elect. 0
0 0 Miscellaneous 0
2 3↓3 Phys. & Mil. Train'g 1
0 0 Foreign Language 6.6
4 6 Social Science 5.3
16.2 24 Science 12
6 9 English 13
12 18↓4 Mathematics 16
96.5 144↓5 Total Prescribed 82
3.4 5↓6 Total Electives 18.
100 149 Grand Total 100
↓ These figures are not in the grand total: they represent the median figures for this group; the exact figures are between 68 and 70, and between 84 and 85. 2 Exact figure between 45 and 48. 3 Exact figure between 2 and 3
4 Exact figure between 17 and 18. 5 Exact figure between 143 and 152. 6 Exact figure between 3 and 5.

GRAPH B. ANALYSIS OF FOUR-YEAR CIVIL ENGINEERING CURRICULA BASED ON THE MEDIAN FIGURES OF THE REQUIREMENTS OF 28 PRIVATELY CONTROLLED SCHOOLS OF ENGINEERING. 1924–1925.



	Names of Institutions	Total Grad. Req.	Total Civil Eng. Subj.	Other Eng. Subj.	Eng. Elect.	Total Non Eng. Subj.
1	University of Missouri	128	24	37	4	63
2	Swarthmore College	148	25	31	–	92
3	Princeton University	145	26	39	12	68
4	State University of Iowa	137	27	49	0	61
5	Colorado School of Mines	165	30	15	42	78
6	University of Georgia	140	30	36	6	68
7	Harvard University	114	30	39	0	45
8	Rutgers University	150	31	38	12	69
9	California Inst. of Technology	171.5	32.6	51.3	0	87.9
10	Clarkson College of Tech.	143.9	32.6	35.3	0	76.
11	University of Michigan	140	33	35	12	60
12	Mass. Inst. of Technology	140	33	35	12	60
13	University of Utah	136.6	34	47.3	0	55.3
14	University of Virginia	158	34	22	0	102
15	University of Mississippi	130	35	43	0	52
16	Yale University	141	35	28	18	60
17	Union College	159	35	40	0	84
18	Carnegie Inst. of Technology	155.5	35.6	46.3	3	70.6
19	University of Notre Dame	154	36	41	0	77
20	University of Alabama	153	37	30	20	66
21	University of Florida	141	38	38	0	65
22	University of North Dakota	150	38	39	12	61
23	Clemson Agri. College	161.5	38	26.5	0	97
24	University of Wyoming	130.6	38	24.6	18	50
25	Lafayette College	142	38	27	12	65
26	Michigan State College	136	38.6	24.6	18.7	54
27	Cornell University	146	39	51	16	40
28	Bucknell University	149	39	32	–	78
29	North Carolina State Coll.	146	39.3	24	0	82.6
30	Colorado Agri. College	160.6	40	23.6	29	68
31	University of Nebraska	125	40	31	5	49
32	Virginia Polytechnic Inst.	151.9	40.6	31.3	0	80
33	University of Arizona	149	41	35	13	60
34	University of Minnesota	136	41.3	41.3	14	39.4
35	Oregon Agricultural Coll.	134.2	41.6	31.3	18.3	53
36	University of New Mexico	144	42	39	0	63
37	University of Tennessee	162	42	36	6	78
38	University of Washington	130.6	42	30.6	10	48
39	University of Wisconsin	146	42	40	11	53
40	University of California	144	43	37	14	50
41	University of Kansas	139	43	32	5	59
42	University of Maryland	152	44	22	(2)*	86
43	West Virginia University	148	45	36	3	64
44	Rose Polytechnic Inst.	149	45	42	0	58
45	Lehigh University	168.5	45.5	38	0	85
46	Georgia School of Tech.	159.3	46	26	0	87.3
47	University of Oklahoma	147	46	42	0	59
48	Purdue University	174.2	46.3	32.6	4	91.3
49	University of Nevada	152	47	32	(16)*	73
50	Pennsylvania State Coll.	161	47	35	4	75
51	University of Maine	151.5	47.5	30	(4)*	74
52	University of Kentucky	191.1	47.8	54	0	89.3
53	Kansas State Agri. Coll.	142	48	30	0	64
54	University of Texas	128	48	26	0	54
55	Leland Stanford University	189.1	48	34.6	0	46.5
56	New York University	188	48	68.	(12)	72
57	Tulane Uni. of Louisiana	167	50	47	0	60
58	Johns Hopkins Uni.	143	50	31	–	62
59	University of Idaho	147	52	24	14	57
60	Iowa State College	139.3	52	22	6	59.3
61	George Washington Uni.	140	52	28	6	54
62	Case School of Applied Sci.	167	52	23	13	79
63	University of Arkansas	135.8	52.6	29.3	11.3	42.6
64	University of Delaware	162.5	53.5	29	0	80
65	University of Illinois	145	54	24	0	67
66	State Coll. of Washington	138	54	23	5+	56
67	Washington U. St. Louis	149	54	25	12	58
68	University of South Carolina	150	55	24	0	71
69	Polytechnic Inst. of Brooklyn	176	56.5	39.5	4	76
70	Howard University	161.6	56.6	30	0	75
71	Alabama Polytechnic Inst.	160.7	57.9	18.9	22	61.9
72	Louisiana State Uni.	143.9	58.6	24	0	61.3
73	University of South Dakota	167	59	44	0	64
74	A. & M. College of Texas	171	59.5	25.5	12	74
75	Syracuse University	168	62	40	3	55
76	Montana State College	144	62.6	20.6	0	60.6
77	University of Pittsburgh	177	63	36	0	78
78	Ohio State University	159.5	63.3	26.6	6	54.6
79	Tufts College	147	65	26	–	56
80	University of Vermont	160	68	20	(6)*	72
81	University of Colorado	161.9	68.6	22	0	51.3
82	Catholic U. of America	193	71	48	0	74
83	Armour Inst. of Technology	196.5	78	43	5	70.5

* Options – not included in total Graduation Requirements.

GRAPH *C*. SHOWING RELATION OF ENGINEERING SUBJECTS TO EACH OTHER BY GROUPS.

prescribed as well as the engineering electives. The totals of graduation requirements and the totals of non-engineering requirements are included for convenience.

PART II.

Summary and Analysis of Entrance Requirements.

TABLE I.

ENTRANCE REQUIREMENTS IN 60 PUBLICLY CONTROLLED INSTITUTIONS.
1924–1925.

Names of Institutions.	Total Units.	Prescribed Units.	Elective Units.	Mathematics.	English.	Physical Science.	Social Science.	Foreign Language.
1	2	3	4	5	6	7	8	9
1. Alabama Polytechnic Institute	15	7	8	3	3	0	1	0
2. University of Alabama	15	6	9	2	3	0	1	0
3. University of Arizona	15	10	5	3	3	1	1	2
4. University of Arkansas	15	6.5	8.5	2.5	3	0	1	0
5. University of California	15	9	6	3	3	2	0	—
6. University of Colorado	15	11	4	3	3	2	1	2
7. Colorado Agricultural College	15	5	10	2	3	0	0	0
8. Colorado School of Mines	15	8	7	3	3	0	2	0
9. Connecticut Agricultural College	14.5	—[1]	—	—	—	—	—	—
10. University of Delaware	15	10	5	3	3	1	1	2
11. University of Florida	16	9	7	4	3	1	1	0
12. University of Georgia	15	9.5	5.5	2.5	3	0	2	2
13. Georgia School of Technology	15	10.5	4.5	3.5	3	1	1	2
14. University of Idaho	15	10	5	3	3	2	2	0
15. University of Illinois	15	7	8	3	3	1	0	0
16. Purdue University	15	8	7	3	3	1	1	0
17. State University of Iowa	15	7	8	3	3	0	1	0
18. Iowa State College	15	7	8	3	3	0	1	0
19. University of Kansas	15	8	7	3	3	2	—	—
20. Kansas State Agricultural College	15	7	8	3	3	1	0	0
21. University of Kentucky	15	7	8	3	3	1	0	0
22. Louisiana State University	16	8.5	7.5	2.5	3	0	1	2
23. University of Maine	14.5	11.5	3	3.5	3	1	1	3 or 4
24. University of Maryland	15	8	7	3	3	1	1	0
25. University of Michigan	15	10	5	3	3	1	1	2
26. Michigan State College	15	7	8	3	3	1	0	0
27. University of Minnesota	15	8	7	3	3	0	0	2
28. University of Mississippi	15	7.5	7.5	2.5	3	0	2	0
29. University of Missouri	15	6	9	1	3	0	0	2

[1] The dash indicates that specific requirements are not listed and does not necessarily indicate that the subject is not required.

Names of Institutions.	Total Units.	Prescribed Units.	Elective Units.	Mathematics.	English.	Physical Science.	Social Science.	Foreign Language.
1	2	3	4	5	6	7	8	9
30. Montana State College	15	8	7	3	3	1	1	0
31. University of Nebraska	15	11	4	2.5	3	2	1	2.5
32. University of Nevada	15	9	6	3	3	2	1	0
33. University of New Hampshire	15	8	7	3	3	1	1	0
34. Rutgers University	15	9	6	4	3	0	0	2
35. University of New Mexico	15	10	5	2	3	1	1	2
36. Cornell University	15	11	4	4	3	0	1	3
37. University of North Carolina	15	10	5	3+	3+	1	1	2
38. North Carolina State College	15	8.5	6.5	2.5	3	1	1	1
39. University of North Dakota	15	7	8	3	3	1	0	0
40. Ohio State University	15	9	6	3	3	1	0	2
41. Municipal University of Akron	15	10	5	3	3	1	1	2
42. University of Cincinnati	15	6.5	8.5	2.5	3	—	1	—
43. University of Oklahoma	15	10	5	3	3	1	1	2
44. Oregon Agricultural College	15	5.5	9.5	2.5	3	0	0	0
45. Pennsylvania State College	15	8	7	3	3	1	1	0
46. University of South Carolina	15	11	4	3	3	1	2	2
47. Clemson Agricultural College	15	7.5	7.5	2.5	3	0	2	0
48. University of South Dakota	15	7	8	2	3	1	1	0
49. University of Tennessee	15	9	6	3	3	3	0	0
50. University of Texas	15	8	7	3	3	0	2	0
51. A. and M. College of Texas	15	6	9	3	3	0	0	0
52. University of Utah	15	6	9	2	3	0	1	0
53. University of Vermont	15	10	5	3	3	1	1	2
54. University of Virginia	15	8	7	4	3	0	1	0
55. Virginia Polytechnic Institute	15	8	7	3	3	1	1	0
56. University of Washington	15	8	7	2	3	0	0	3
57. State College of Washington	15	8	7	3	4	1	0	0
58. West Virginia University	15	7	8	3	4	—	—	—
59. University of Wisconsin	15	12[1]	3	3	3	2	2	2
60. University of Wyoming	15	11	4	3	3	1	2	2

[1] Advised.

TABLE I—CONTINUED.

ENTRANCE REQUIREMENTS IN 32 PRIVATELY CONTROLLED INSTITUTIONS.

Names of Institutions.	Total Units.	Prescribed Units.	Elective Units.	Mathematics.	English.	Physical Science.	Social Science.	Foreign Language.
1	2	3	4	5	6	7	8	9
1. Leland Stanford Junior University	15	13.5	1.5	3.5	4	2	1	2
2. California Institute of Technology	15	10	5	4	3	2	1	0
3. Yale University	15	11	4	3	3	1	1	3 or 4
4. George Washington University.	15	11	4	4	3	2	0	2
5. Catholic University of America.	15	8	7	2	3	0	1	2
6. Howard University	15	5	10	2	3	—	—	—
7. Armour Institute of Technology	15	12.5	2.5	3.5	3	2	1	2
8. University of Notre Dame	15	9	6	2	3	1	1	2
9. Rose Polytechnic Institute	16	9	7	—	—	—	—	—
10. Tulane University of Louisiana.	15	9.5	5.5	2.5	3	2	0	2
11. Johns Hopkins University	15	10.5	4.5	2.5	3	0	1	4
12. Harvard University	15	11	4	3	3	1	1	3
13. Tufts College	15	9	6	3	3	0	1	2
14. Massachusetts Institute of Technology	15	13	2	4	3	2	1	4 or 3
15. Worcester Polytechnic Institute	14.5	10.5	4	3.5	3	1	1	2
16. Washington University (St. Louis)	15	6	9	1	1	4	0	2+
17. Stevens Institute of Technology	14.5	11	3.5	4	3	2	1	1
18. Princeton University	15	12	3	4	3	1	0	4
19. Polytechnic Institute of Brooklyn	15	9.5	5.5	3.5	3	1	0	2 or 3
20. New York University	15	10.5	4.5	3.5	3	1	0	3
21. Clarkson College of Technology	15	12	3	3	3	1	1	4
22. Union College	15	9.5	5.5	2.5	3	1	1	2
23. Syracuse University	15	8	7	3	3	0	0	2
24. Rensselaer Polytechnic Institute	15	10	5	3	3	1	1	2
25. Case School of Applied Science.	15	10	5	3	3	2	0	2
26. Lehigh University	15	9.5	5.5	3.5	3	0	1	2
27. Lafayette College	15	9.5	5.5	3.5	3	1	0	2
28. Bucknell University	15	9.5	5.5	2.5	3	1	1	2
29. University of Pennsylvania	15	10.5	4.5	3.5	3	1	1	2
30. Swarthmore College	15	9.5	5.5	3.5	3	0	1	2
31. Carnegie Institute of Technology	15	9	6	3	3	1	0	2
32. University of Pittsburgh	15	9	6	3	3	0	1	2

Analysis of Entrance Requirements.

1. *Total Entrance Requirements.*

Of the 92 institutions of our list 85 require a total of 15 high school units for admission to the regular four year courses of study. The following named institutions prescribe 14½ units for entrance: Connecticut Agricultural College, University of Maine, Worcester Polytechnic Institute, and Stevens Institute of Technology; sixteen units are prescribed for entrance by the University of Florida, Louisiana State University, and Rose Polytechnic Institute.

2. *Total Prescribed Entrance Requirements.*

The following tables show the principal frequencies or modal tendencies of total prescribed entrance requirements in 60 public and 32 private institutions, also minimum, maximum and median figures.

Total Prescribed Entrance Units. Principal Frequencies.

Number of Cases.	In Public Institutions.	In Private Institutions.	Number of Prescribed Units.
10	10	0	7
15	13	2	8
11	6	5	9
8	1	7	9½
12	9	3	10
9	5	4	11

Minimum, Maximum, and Median Prescribed Entrance Units.

Requirements.	For All Institutions (92).	For Public Institutions (60).	For Private Institutions (32).
Minimum.....	0 or 5[1] units	0 or 5[1] units	5 units
Maximum.....	13½ units	12 units	13½ units
Median.....	9 units	8 units	10 units

[1] In one case, Connecticut Agricultural College, the prescribed requirements are not specifically listed.

3. *Total Elective Entrance Requirements.*

The tables following show the principal frequencies or modal tendencies of the total elective entrance requirements in the 60 public and 32 private institutions of our list, also minimum, maximum and median figures.

TOTAL ELECTIVE ENTRANCE UNITS. PRINCIPAL FREQUENCIES.

Number of Cases.	In Public Institutions.	In Private Institutions.	Number of Elective Units Allowed.
9	5	4	4
12	9	3	5
8	1	7	5½
9	5	4	6
17	14	3	7
10	10	0	8

MINIMUM, MAXIMUM, AND MEDIAN ELECTIVE ENTRANCE UNITS.

Requirements.	For All Institutions (92).	For Public Institutions (60).	For Private Institutions (32).
Minimum.....	0 or 1.5[1]	0 or 3[1]	1.5
Maximum.....	10	10	10
Median.....	6	7	5

4. *Entrance Requirements in Mathematics.*

The tables following show the principal frequencies or modal tendencies of the prescribed entrance requirements in mathematics, also minimum, maximum and median figures.

ENTRANCE REQUIREMENTS IN MATHEMATICS. PRINCIPAL FREQUENCIES.

Number of Cases.	In Public Institutions.	In Private Institutions.	Number of Prescribed Units.
8	4	4	2
13	9	4	2.5
47	38	9	3
11	2	9	3.5
9	4	5	4

[1] In one case, Connecticut Agricultural College, the elective requirements are not specified.

MINIMUM, MAXIMUM, AND MEDIAN ENTRANCE REQUIREMENTS IN MATHEMATICS.

Requirements.	For All Institutions (92).	For Public Institutions (60).	For Private Institutions (32).
Minimum.....	0 or 1	0 or 1	0 or 1
Maximum.....	4	4	4
Median.....	3	3	3

5. *Entrance Requirements in English.*

The tables following show the principal frequencies or modal tendencies of the prescribed entrance requirements in English, also minimum, maximum and median figures.

ENTRANCE REQUIREMENTS IN ENGLISH. ALL FREQUENCIES.

Number of Cases.	In Public Institutions.	In Private Institutions.	Number of Prescribed Units.
2	1[1]	1[1]	0
1	0	1	1
86	57	29	3
3	2	1	4

MINIMUM, MAXIMUM, AND MEDIAN ENTRANCE REQUIREMENTS IN ENGLISH.

Requirements.	For All Institutions (92).	For Public Institutions (60).	For Private Institutions (32).
Minimum.....	0 or 1	0 or 3	0 or 1
Maximum.....	4	4	4
Median.....	3	3	3

6. *Entrance Requirements in Physical Science.*

The tables following show the principal frequencies or modal tendencies of the prescribed entrance requirements in Physical Science, also minimum, maximum and median figures.

[1] Specific subjects are not indicated by Connecticut Agricultural College and Rose Polytechnic Institute.

ENTRANCE REQUIREMENTS IN PHYSICAL SCIENCE. ALL FREQUENCIES.

Number of Cases.	In Public Institutions.	In Private Institutions.	Number of Prescribed Units.
33	24	9	0
42	28	14	1
15	7	8	2
1	1	0	3
1	0	1	4

MINIMUM, MAXIMUM, AND MEDIAN ENTRANCE REQUIREMENTS IN PHYSICAL SCIENCE.

Requirements.	For All Institutions (92).	For Public Institutions (60).	For Private Institutions (32).
Minimum.....	0 or 1	0 or 1	0 or 1
Maximum.....	4	3	4
Median.....	1	1	1

7. *Entrance Requirements in Social Science.*

The tables following show the frequencies or modal tendencies of the prescribed entrance requirements in Social Science, also minimum, maximum and median figures.

ENTRANCE REQUIREMENTS IN SOCIAL SCIENCE. ALL FREQUENCIES.

Number of Cases.	In Public Institutions.	In Private Institutions.	Number of Prescribed Units.
29	18	11	0
53	33	20	1
10	9	1	2

MINIMUM, MAXIMUM, AND MEDIAN ENTRANCE REQUIREMENTS IN SOCIAL SCIENCE.

Requirements.	For All Institutions (92).	For Public Institutions (60).	For Private Institutions (32).
Minimum.....	0 or 1	0 or 1	0 or 1
Maximum.....	2	2	2
Median.....	1	1	1

8. *Entrance Requirements in Foreign Language.*

The tables following show the frequencies or modal tendencies of the prescribed entrance requirements in Foreign Language, also minimum, maximum and median figures.

ENTRANCE REQUIREMENTS IN FOREIGN LANGUAGE. ALL FREQUENCIES.

Number of Cases.	In Public Institutions.	In Private Institutions.	Number of Prescribed Units.
39	36	3	0
2	1	1	1
40	19	21	2
1	1	0	2.5
6	3	3	3
4	0	4	4

MINIMUM, MAXIMUM, AND MEDIAN ENTRANCE REQUIREMENTS IN FOREIGN LANGUAGE.

Requirements.	For All Institutions (92).	For Public Institutions (60).	For Private Institutions (32).
Minimum.....	0 or 1	0 or 1	0 or 1
Maximum.....	4	3	4
Median.....	2	0	2

9. *Entrance Requirements in Other Specified Subjects.*

Three institutions prescribe drawing in addition to the general academic entrance prescriptions. The University of California prescribes one unit of geometrical drawing. Leland Stanford University and Armour Institute of Technology respectively prescribe one unit of mechanical drawing.

PART III.

Summary and Analysis of Graduation Requirements in Civil Engineering.

TABLE II.

GRADUATION REQUIREMENTS IN 55 PUBLICLY

Names of Institutions.	Total Semester Hours.	Total Prescribed Semester Hours.	Total Elective Semester Hours.
1. Alabama Polytechnic Institute	160.7	138.7	22
2. University of Alabama	153	133	20
3. University of Arizona	149	136	13
4. University of Arkansas.*	136	124.6	11.3
5. University of California	144	128	16
6. University of Colorado *	142	142	0
7. Colorado Agricultural College	161	132	29
8. Colorado School of Mines	165	123	42
9. University of Delaware	162.5	162.5	0
10. University of Florida	141	141	0
11. University of Georgia	140	134	6
12. Georgia School of Technology	159.3	159.3	0
13. University of Idaho	147	133	14
14. University of Illinois	145	136	9
15. Purdue University	174.3	164.3	10
16. State University of Iowa	137	137	0
17. Iowa State College.*	139.3	133.3	6
18. University of Kansas	139	129	10
19. Kansas State Agricultural College	142	142	0
20. University of Kentucky	191	191	0
21. Louisiana State University.*	144	144	0
22. University of Maine	151.5	151.5	0
23. University of Maryland	152	152	0
24. University of Michigan	140	128	12
25. Michigan State College.*	136	111.3	24.7
26. University of Minnesota.*	136	122	14
27. University of Mississippi	130	130	0
28. University of Missouri	128	124	4
29. Montana State College.*	144	144	0
30. University of Nebraska	125	120	5
31. University of Nevada	152	138	14
32. Rutgers University	150	138	12
33. University of New Mexico	144	144	0
34. Cornell University	145	130	15
35. North Carolina State College.*	146	128	18
36. University of North Dakota	150	138	12
37. Ohio State University.*	159.5	153.5	6
38. University of Oklahoma	147	147	0
39. Oregon Agricultural College	138	124.7	13.3
40. Pennsylvania State College	161	157	4
41. University of South Carolina	150	150	0
42. Clemson Agricultural College	161.5	161.5	0
43. University of South Dakota	167	167	0
44. University of Tennessee	162	156	6
45. University of Texas.*	128	128	0
46. A. and M. College of Texas	171	159	12
47. University of Utah.*	136.6	131.3	5.3
48. University of Vermont	160	154	6
49. University of Virginia	158	158	0
50. Virginia Polytechnic Institute.*	152	152	0
51. University of Washington	130.6	120.6	10
52. State College of Washington	138	133	5
53. West Virginia University	148	145	3
54. University of Wisconsin	141	138	3
55. University of Wyoming.*	130.6	112.6	18

* Figures reduced to semester hours from a term or quarter basis.

TABLE II.

CONTROLLED INSTITUTIONS. 1924–1925.

Mathematics.	English.	Physical Science.	Social Science.	Foreign Language.	Physical and Military Training.	Miscellaneous Subjects.	Non-Engineering Electives.	Civil Engineering.	Other Engineering.	Engineering Electives.
20	12	18.3	5	0	6.6	0	0	57.9	18.9	22
20	4	28	10	0	4	0	0	37	30	20
19	10	18	0	8	4.5	.5	0	41	35	13
12	6	20.6	0	0	4	0	(11.3)	52.6	29.3	11.3
12	**	25	2	0	9	0	2	43	37	14
21.3	8.7	18	1.3	0	2	0	0	68.6	22	0
24	6	20	2	0	16	0	0	40	23.6	29
20	6	44	0	0	8	0	—	30	15	42
16	12	23	7	6	16	0	0	53.5	29	0
16	8	29	3	0	9	0	0	38	38	0
18	6	32	0	12	—	0	0	30	36	6
23.7	15	25	5	12	6.7	0	0	46	26	0
18	9	22	0	0	8	0	(14)	52	24	14
18	6	20	0	8	6	0	9	54	24	0
20	12	16	6	10	21.3	0	6	46.3	32.6	4
20	12	21	8	0	0	0	0	27	49	0
24	8.7	23.3	7.3	0	4	0	0	52	22	6
20	11	20	3	0	0	0	5	43	32	5
18	10	22	8	0	6	0	0	48	30	0
25	22	32	3	0	7.3	0	0	47.8	54	0
18	12	23.3	0	0	8	0	(2)	58.6	24	0
20	12	27	15	0	0	0	0	47.5	30	(4)
20	14	22	8	14	8	0	(6)	44	22	(2)
18	6	20	0	16*	0	0	*	33	35	12
16	8	16	(12)	(6)	8	0	6	38.6	24.6	18.7
16.7	6	16.7	0	0	0	0	(14)	41.3	41.3	14
18	6	22	0	6	0	0	0	35	43	0
20	12	18	5	0	8	0	0	24	37	4
18	10	20.6	4	0	8	0	0	62.6	20.6	0
20	4	16	3	0	4	2***	0	40	31	5
16	6	22	2	0	10	3	14	47	32	(14)
20	12	16	6	6	9	0	(12)	31	38	12
18	9	22	(12 or 16)	12 or 16	2.5	0	0	42	39	0
11	6	15	8	0	—	0	(15)	39	51	15
22.6	12	20	2	0	8	0	18	39.3	24	0
18	10	21	6	0	6	0	0	38	39	12
20	8	20	0	0	6.6	0	0	63.3	35.6	6
19	8	21	7	0	4	0	0	46	42	0
16	8	14	4	0	10	0	0	41.6	31.3	13.3
16	10	19	12	8	9	1	0	47	35	4
12	6	47	0	6	0	0	0	55	24	0
21	16	24	10	0	20	6	0	38	26.5	0
18	6	25	3	0	12	0	0	59	44	0
18	12	28	0	0	20	0	(12)	42	36	6
16	14	18	6	0	0	0	0	48	26	0
22	16	22	6	0	8	0	(12)	59.5	25.5	12
16.6	6	22	3.3	0	2	0	5.3	34	47.3	0
24	8	26	4	0	12	0	0	66	20	6
18	12	54	18	0	0	0	0	34	22	0
20	12	22	4	0	21	.9	0	40.6	31.3	0
12	2	23.3	4	0	6.6	0	(10)	42	30.6	10
16	8	18	7	0	7	0	(5+)	54	23	5+
16	7	27	10	0	4	0	0	45	36	3
18	10	24	4	0	—	0	3	42	40	(3)
18	6	18	0	0	8	0	0	38	24.6	18

* Figures reduced to semester hours from a term or quarter basis.
** Examination required.
*** Orientation.
(+) indicates that the electives are not always clearly defined either as engineering or non-engineering electives.

TABLE II—

GRADUATION REQUIREMENTS IN 28

Names of Institutions.	Total Semester Hours.	Total Prescribed Semester Hours.	Total Elective Semester Hours.
1. Leland Stanford University	129	129	0
2. California Institute of Technology	172	170.6	1.3
3. Yale University	141	123	18
4. George Washington University	140	134	6
5. Catholic University of America	193	193	0
6. Howard University *	161.6	161.6	0
7. Armour Institute of Technology	196.5	191.5	5
8. University of Notre Dame	154	154	0
9. Rose Polytechnic Institute	143	143	0
10. Tulane University of Louisiana	157	157	0
11. Johns Hopkins University	143	143	—
12. Harvard University	114	108	6
13. Tufts College	147	137	10
14. Massachusetts Institute of Technology	140	128	12
15. Washington University (St. Louis)	149	137	12
16. Princeton University	145	133	12
17. Polytechnic Institute of Brooklyn	176	166	10
18. New York University	188	176	12
19. Clarkson College of Technology	134	134	0
20. Union College	159	159	0
21. Syracuse University	168	165	3
22. Case School of Applied Science	167	154	13
23. Lehigh University	168.5	168.5	0
24. Lafayette College	142	130	12
25. Bucknell University	149	143	6
26. Swarthmore College	148	128	20
27. Carnegie Institute of Technology	155.6	152.6	3
28. University of Pittsburgh	177	177	0

CONTINUED

PRIVATELY CONTROLLED INSTITUTIONS.

Mathematics.	English.	Physical Science.	Social Science.	Foreign Language.	Physical and Military Training.	Miscellaneous Subjects.	Non-Engineering Elective.	Civil Engineering.	Other Engineering.	Engineering Electives.
13.3	10	8.6	10.6	0	4	0	0	48	34.6	0
14	20	30	8	0	14.6	0	1.3	32.6	51.3	0
12	12	20	16	0	0	0	(18)	35	28	18
12	6	24	6	6	0	0	0	52	28	6
22	6	25	1	6	0	14	0	71	48	0
20	10	20	10	0	15	0	0	56.6	30	0
18	9	31.5	8	0	0	4	0	78	43	5
24	10	28	3	0	0	14	0	36	41	0
17	8	15	2	10	4	0	0	45	42	0
20	15	20	3	0	0	2	0	50	47	0
16	10	24	6	6	0	0	0	50	31	—
12	6	15	6	0	0	0	6	30	39	0
15	6	16	6	0	3	0	10	65	26	—
18	6	20	0	(16)	0	0	(16)	33	35	12
17	8	23	6	0	4	0	(12)	54	25	12
12	8	20	14	12	2	0	(12)	26	39	12
20	13	25	8	0	4	0	6	56.5	39.5	4
14	16	29	2	—	6	0	6	48	67	(12)
22	6	34	0	0	4	0	0	32.6	35.3	0
22	14	19	17	10	2	0	0	35	40	0
18	8	26	3	0	0	0	0	62	48	3
18	12	29	2	11	7	0	0	52	23	13
15	9	33	6	6	11.7	4.3	0	45.5	38	0
17	6	24	6	0	4	8	(12)	38	27	12
20	6	32	0	12	0	2	6	39	32	—
19	10	24	9	10	—	0	20	25	31	—
18	6	21	21	0	4.6	0	0	35.6	46.3	3
14	14	28	7	0	8	7	0	63	36	0

ANALYSIS OF GRADUATION REQUIREMENTS IN CIVIL ENGINEERING.

1. *Total Graduation Requirements in Civil Engineering.*

There are 51 distinct cases of Total Graduation Requirements in Civil Engineering in the list of 83 colleges of engineering considered here. These totals vary from 114 to 196.5 semester hour credits.

The following tables show in terms of semester hour credits the principal frequencies or modal tendencies of the "total graduation requirements in Civil Engineering" in 55 public and 28 private institutions, also the minimum, maximum, and median figures.

TOTAL GRADUATION REQUIREMENTS.

Number of Cases.	In Public Institutions.	In Private Institutions.	Number of Graduation Requirements in S. H. Credits.
1	0	1	114
4	3	1	125 to 129
12	11	1	130 to 139.3
29	18	11	140 to 149
15	11	4	150 to 159.3
12	8	4	160 to 169
5	2	3	171 to 177
1	0	1	188
3	1	2	191 to 196.5

MINIMUM, MAXIMUM, AND MEDIAN "TOTAL GRADUATION REQUIREMENTS."

Requirements.	For All Institutions (83).	For Public Institutions (55).	For Private Institutions (28).
Minimum.....	114	125	114
Maximum.....	196.5	191	196.5
Median.....	147	146	149

The tables show a distinct modal tendency in the group of 140 to 149 semester hour credits. In the sub-mode group of 130 to 139.3 the public institutions greatly predominate. In the super-mode groups of 150 to 159.3 and 160 to 169 both public and private institutions are more proportionately represented.

They also show a tendency on the part of private institutions to require a greater number of hours for graduation than in the case of the public institutions.

2. *Total Prescribed Semester Hour Credits in Civil Engineering.*

The following tables show the principal frequencies or modal tendencies in the total prescribed semester hour credits in Civil Engineering, also minimum, maximum, and median figures.

TOTAL PRESCRIBED SEMESTER HOUR CREDITS.

Number of Cases.	In Public Institutions.	In Private Institutions.	Number of Prescribed S. H. Credits.
1	0	0	108
2	2	0	111.3 to 112
16	12	4	120 to 129
23	17	6	130 to 139
11	8	3	141 to 147
16	11	5	150 to 159
8	4	4	161 to 169
3	0	3	170 to 177
3	1	2	191 to 193

MINIMUM, MAXIMUM AND MEDIAN "TOTAL PRESCRIBED SEMESTER HOUR CREDITS."

Requirements.	For All Institutions (83).	For Public Institutions (55).	For Private Institutions (28).
Minimum.....	108	111.3	108
Maximum.....	193	191	193
Median.....	bet. 137 and 141	138	bet. 143 and 152

The tables show a distinct modal tendency in the group of 130 to 139 semester hour credits. In the sub-mode group of 120 to 129, the public institutions predominate. In the supermode groups of 141 to 147 and 150 to 159 both public and private institutions are more proportionately represented.

They also show a tendency on the part of private institutions to prescribe a greater number of hours in addition to other work than in the case of the public institutions.

3. *Total Elective Semester Hour Credits in Civil Engineering.*

The following tables show the principal frequencies or modal tendencies in the total elective semester hour credits in Civil Engineering, also the minimum, maximum and median figures.

TOTAL ELECTIVE SEMESTER HOUR CREDITS.

Number of Cases (83).	In Public Institutions (55).	In Private Institutions (28).	Number of Elective S. H. Credits.
31	20	11	0
20	13	7	3 to 9
26	17	9	10 to 18
5	4	1	20 to 29
1	1	0	42

MINIMUM, MAXIMUM, AND MEDIAN, "TOTAL ELECTIVE SEMESTER HOUR CREDITS."

Requirements.	For All Institutions (83).	For Public Institutions (55).	For Private Institutions (28).
Minimum.....	0 or 1.3	0 or 3	0 or 1.3
Maximum.....	42	42	20
Median.....	6	bet. 5 and 6	bet. 3 and 5

The tables show that 37 per cent. of all the schools, 36 per cent. of the public institutions, and 40 per cent. of the private institutions offer no electives in the civil engineering curriculum.

The institutions offering electives are quite equally divided between the groups of 3 to 9 and 10 to 18 semester hour credits in electives.

They also show that the public institutions tend to allow more elective work than those which are private.

4. *Graduation Requirements in Mathematics, Civil Engineering Curricula.*

The following tables show the principal frequencies or modal tendencies for graduation requirements in Mathematics, also the minimum, maximum, and median figures.

GRADUATION REQUIREMENTS IN MATHEMATICS.

Number of Cases.	In Public Institutions.	In Private Institutions.	S. H. Credits Prescribed in Mathematics.
8	4	4	12
10	9	1	16
20	15	5	18
17	13	4	20

MINIMUM, MAXIMUM, AND MEDIAN GRADUATION REQUIREMENTS, IN MATHEMATICS.

Requirements.	For All Institutions (83).	For Public Institutions (55).	For Private Institutions (28).
Minimum.....	11	11	12
Maximum.....	25	25	24
Median.....	18	18	17

The tables show that the requirements in Mathematics follow four distinct groupings with 18 semester hours predominating.

They also show that the public institutions seem to favor 1 semester hour more in mathematics than the private institutions.

5. *Graduation Requirements in English, Civil Engineering Curricula.*

The following tables show the principal frequencies or modal tendencies for graduation requirements in English, also the minimum, maximum, and median figures.

GRADUATION REQUIREMENTS IN ENGLISH.

Number of Cases.	In Public Institutions.	In Private Institutions.	S. H. Credits Prescribed in English.
1	1	0	0[1]
22	13	9	6
11	7	4	8
11	6	5	10
15	13	2	12

MINIMUM, MAXIMUM, AND MEDIAN GRADUATION REQUIREMENTS IN ENGLISH.

Requirements.	For All Institutions (83).	For Public Institutions (55).	For Private Institutions (28).
Minimum.....	0 or 2	0 or 2	6
Maximum.....	22	22	20
Median.....	10	9	9

[1] University of California requires an examination in English.

The tables show that the requirements in English follow as in Mathematics four distinct groupings with six semester hours predominant.

They also show that the median requirements in English are the same for both types of engineering schools.

6. *Graduation Requirements in Physical Science: Civil Engineering Curricula.*

The following tables show the principal frequencies or modal tendencies, for graduation requirements in Physical Science, also the minimum, maximum, and median figures.

GRADUATION REQUIREMENTS IN PHYSICAL SCIENCE.

Number of Cases (83).	In Public Institutions (55).	In Private Institutions (28).	S. H. Credits Prescribed in Physical Science.
19	15	4	14 to 19
11	6	5	20
9	9	0	22
27	15	12	23 to 29

MINIMUM, MAXIMUM AND MEDIAN GRADUATION REQUIREMENTS IN PHYSICAL SCIENCE.

Requirements.	For All Institutions.	For Public Institutions.	For Private Institutions.
Minimum.....	8.6	14	8.6
Maximum.....	54	54	34
Median.....	22	22	24

The tables show that the requirements in Physical Science follow four distinct groupings with 20 semester hours predominant as a single figure, however nearly one third of the schools prescribe between 23 and 29 semester hour credits in this subject.

They also show that the requirements in Physical Science in the private institutions tend to exceed those in the public institutions by 2 semester hour credits.

7. *Graduation Requirements in Social Science: Civil Engineering Curricula.*

The following tables show the principal frequencies or modal tendencies for graduation requirements in Social Science, also the minimum, maximum, and median figures.

GRADUATION REQUIREMENTS IN SOCIAL SCIENCE.

Number of Cases (83).	In Public Institutions (55).	In Private Institutions (28).	S. H. Credits Prescribed in Social Science.
18	15	3	0
27	20	7	1 to 5
12	5	7	6
13	8	5	7 to 9
13	7	6	10 to 21

MINIMUM, MAXIMUM AND MEDIAN GRADUATION REQUIREMENTS IN SOCIAL SCIENCE.

Requirements.	For All Institutions.	For Public Institutions.	For Private Institutions.
Minimum.....	0 or 1	0 or 1.3	0 or 1
Maximum.....	21	18	21
Median.....	4	4	6

The tables show that 27 per cent. of the public and nearly 10 per cent. of the private institutions do not prescribe social science. The principal group with positive prescriptions varies from 1 to 5 semester hours.

They also show that the private institutions tend to prescribe 2 semester hours more in Social Science than the public institutions.

8. *Graduation Requirements in Foreign Language: Civil Engineering Curricula.*

The following tables show the principal frequencies or modal tendencies for graduation requirements in Foreign Language, also minimum, maximum, and median figures.

GRADUATION REQUIREMENTS IN FOREIGN LANGUAGE.

Number of Cases (83).	Number of Public Institutions (55).	Number of Private Institutions (28).	Semester Hour Credits Prescribed in Foreign Language.
47	29	18	0
8	4	4	6
3	3	0	8
4	1	3	10
1	0	1	11
4	2	2	12
1	1	0	14
1	1	0	16

MINIMUM, MAXIMUM AND MEDIAN GRADUATION REQUIREMENTS IN FOREIGN LANGUAGE.

Requirements.	For All Institutions.	For Public Institutions.	For Private Institutions.
Minimum.....	0 or 6	0 or 6	0 or 6
Maximum.....	16	16	12
Median.....	0	0	0

The tables show that nearly 53 per cent. of the public and nearly 64 per cent. of the private institutions do not prescribe foreign language for graduation in civil engineering.

Considering the number of schools there is no marked modal tendency.

They also clearly indicate the negative aspect of foreign language as a prescribed subject.

9. *Graduation Requirements in Physical and Military Training, and Hygiene.*

The following tables show the principal frequencies or modal tendencies for graduation requirements in Physical and Military Training, including Hygiene, also minimum, maximum, and median figures.

GRADUATION REQUIREMENTS IN PHYSICAL AND MILITARY TRAINING, INCLUDING HYGIENE.

Number of Cases (83).	Number of Public Institutions (55).	Number of Private Institutions (28).	Semester Hour Credits Prescribed in Physical and Military Training.
24	12	12	0
6	3	3	1 to 3
12	6	6	4
11	10	1	8
16	13	3	9 to 21.3

MINIMUM, MAXIMUM, AND MEDIAN GRADUATION REQUIREMENTS IN PHYSICAL AND MILITARY TRAINING, INCLUDING HYGIENE.

Requirements.	For All Institutions.	For Public Institutions.	For Private Institutions.
Minimum.....	0 or 2	0 or 2	0 or 2
Maximum.....	21	21	15
Median.....	4	6.6	between 2 or 3

The tables show that nearly 22 per cent. of the public and 43 per cent. of the private institutions do not prescribe Physical or Military Training, etc. The public institutions requiring these subjects tend to fall in the higher groupings of 8 semester hours or from 9 to 21.3.

They likewise show that the public institutions tend to prescribe more than twice as much in these subjects as do the private institutions.

10. *Graduation Requirements in Prescribed Miscellaneous Subjects.*

Fourteen of the 83 institutions considered in this study prescribe certain subjects for graduation in Civil Engineering in addition to those already mentioned.

These subjects included to large extent Orientation courses, also Bible, Religion, and Psychology.

11. *Graduation Requirements: Non-Engineering Electives.*

Thirty-two institutions of the 83 listed allow non-engineering electives as a part of the graduation requirements in Civil Engineering. The table following shows the most important frequencies, also the median, maximum, and minimum figures for these electives.

GRADUATION REQUIREMENTS: NON-ENGINEERING ELECTIVES.

Requirements.	For All Institutions.	For Public Institutions.	For Private Institutions.
Principal frequencies....	0	0	0
	6	6	6
	12	12	12
Minimum.....	0 or 1.3	0 or 2	1.3
Maximum.....	20	18	20
Median.....	0	0	0

The table shows two definite groupings of positive requirements which are the same for both types of engineering schools, namely 6 and 12 semester hours.

12. *Graduation Requirements in Civil Engineering: Total Non-Engineering Subjects.*

The following tables show the principal frequencies or modal tendencies, in total non-engineering subjects, also the minimum, maximum, and median figures.

TOTAL NON-ENGINEERING SUBJECTS.

Number of Cases.	In Public Institutions.	In Private Institutions.	Semester Hour Credits in Non-Engineering Subjects.
7	5	2	40 to 49
20	15	5	50 to 59.3
25	18	7	60 to 69
18	8	10	71 to 79
9	6	3	80 to 89.3
3	2	1	91 to 97
1	1	0	102

MINIMUM, MAXIMUM, AND MEDIAN FIGURES. TOTAL NON-ENGINEERING SUBJECTS.

Requirements.	For All Institutions.	For Public Institutions.	For Private Institutions.
Minimum.....	40	40	45
Maximum.....	102	102	92
Median.....	64	60	Between 68 and 70

The tables show 2 prominent groups in Total Non-Engineering Subjects—from 50 to 59.3, and from 60 to 69 semester hour credits. The private institutions are stronger in the next group—from 71 to 79 semester hour credits.

They also show that the private institutions require from 8 to 10 more hours in non-engineering subjects than the public institutions.

13. *Graduation Requirements in Civil Engineering: Total Engineering Subjects.*

The following tables show the principal frequencies or modal tendencies in "Total Engineering Subjects," also minimum, maximum, and median figures.

TOTAL ENGINEERING SUBJECTS.

Number of Cases.	In Public Institutions.	In Private Institutions.	Semester Hour Credits in Engineering Subjects.
2	1	1	51 to 56
6	4	2	63 to 69
18	13	5	72 to 79
36	25	11	80 to 89
12	8	4	90 to 99
5	4	1	100 to 105
4	0	4	113 to 126

MINIMUM, MAXIMUM, AND MEDIAN. TOTAL ENGINEERING SUBJECTS.

Requirements.	For All Institutions.	For Public Institutions.	For Private Institutions.
Minimum.....	51	56	51
Maximum.....	126	105	126
Median.....	82.6	80	Bet. 84 and 85

The tables show that the favorite groupings in "Engineering Subjects" are from 72 to 79 and from 80 to 89 semester hour credits.

They also show that the private institutions tend to offer nearly 5 hours more in engineering subjects than the public institutions.

14. *Graduation Requirements in Specific Subjects in Civil Engineering.*

The following tables show the principle frequencies or modal tendencies in Specific Subjects in Civil Engineering also minimum, maximum, and median figures. Specific civil engineering subjects include courses in surveying, geodesy, structural design, structures, railway engineering, highway engineering, bridges, masonry, reinforced concrete, sewerage and contracts and specifications; but do not include strength of materials, mechanics of materials, statics, kinetics or hydraulics.

Where the curriculum is specialized from the beginning by options the writer has chosen for this study the so-called structural option.

SPECIFIC SUBJECTS IN CIVIL ENGINEERING.

Number of Cases.	In Public Institutions.	In Private Institutions.	Semester Hour Credits in Specific Civil Engineering Subjects.
4	2	2	24 to 27
25	15	10	30 to 39
27	23	4	40 to 48
18	11	7	50 to 59.5
7	4	3	62 to 68.6
2	0	2	71 to 78

MINIMUM, MAXIMUM, AND MEDIAN, SPECIFIC SUBJECTS IN CIVIL ENGINEERING.

Requirements.	For All Institutions.	For Public Institutions.	For Private Institutions.
Minimum.....	24	24	25
Maximum.....	68.6	68.6	78
Median.....	43	43	Bet. 45 and 48

The tables show 3 distinct groupings. From 30 to 39 semester hours seems to be more favored by the private institutions while the two higher groups of 40 to 48 and 50 to 59 are well represented by the public as well as private institutions.

They also show that the private institutions tend to prescribe a little more in specific civil engineering subjects than the public institutions.

15. *Graduation Requirements in Engineering Subjects other than Civil Engineering.*

The following tables show the principal frequencies or modal tendencies in "Other Engineering Subjects," also minimum, maximum, and median figures. These subjects include engineering drawing, drafting, general engineering, mechanical engineering, electrical engineering, mechanics, strength of materials, mechanics of materials, hydraulics, heat engines, descriptive geometry, kinematics, statics and other subjects which are not specific civil engineering subjects.

"OTHER ENGINEERING SUBJECTS."

Number of Cases.	In Public Institutions.	In Private Institutions.	Semester Hour Credits in Other Engineering Subjects.
2	2	0	15 to 18.9
27	21	6	20 to 29.3
35	23	12	30 to 39.5
15	7	8	40 to 49
3	2	1	51 to 54
1	0	1	67

MINIMUM, MAXIMUM, AND MEDIAN "OTHER ENGINEERING SUBJECTS."

Requirements.	For All Institutions.	For Public Institutions.	For Private Institutions.
Minimum.....	15.	15	23
Maximum.....	67	54	67
Median.....	Bet. 32 and 34	30.6	36

The tables show 3 distinct groupings; the strongest being from 30 to 39.5 semester hours in "Other Engineering Subjects."

They also indicate that the private institutions, prescribe nearly 6 hours more in this requirement than the public institutions.

16. *Graduation Requirements in Engineering Electives.*

The following tables show the principal frequencies or modal tendencies in the Engineering Electives of Civil Engineering Curricula, also, the minimum, maximum, and median figures.

ENGINEERING ELECTIVES.

Number of Cases.	In Public Institutions.	In Private Institutions.	Semester Hour Credits in Engineering Electives.
37	21	16	0
20	15	5	1 to 10
22	15	7	10 to 18.7

MINIMUM, MAXIMUM, AND MEDIAN ENGINEERING ELECTIVES.

Requirements.	For All Institutions.	For Public Institutions.	For Private Institutions.
Minimum.....	0 or 2	0 or 2	0 or 3
Maximum.....	42	42	18
Median.....	3	4	0

The tables show that nearly 40 per cent. of the public institutions and 57 per cent. of the private institutions do not allow engineering electives (general options are not included in this statement).

The positive cases show that the 2 groups include a proportionate number of both public and private institutions.

The data in the second table clearly reinforce the statements made in the preceding paragraph.

Comparison of Civil Engineering Graduation Requirements in Public and Private Institutions.

An analysis of the foregoing tables will show that the private institutions exceed the public institutions in the following requirements for graduation in civil engineering, and to the extent indicated, namely:

3 semester hours in total graduation requirements.
5 semester hours in total prescribed credits.
2 semester hours in science.
2 semester hours in social science.
8 semester hours in total non-engineering subjects.
2 semester hours in specific civil engineering subjects.
5 semester hours in other engineering subjects.
4 semester hours in total engineering subjects.

On the other hand the public institutions exceed the private institutions in the following requirements and to the extent indicated, namely:

2 semester hours in total elective credits.
1 semester hour in mathematics.
3.6 semester hours in physical education, etc.
4 semester hours in engineering electives.

Both public and private institutions have the same median requirements in English (9 semester hours). The median requirements of both groups in foreign language and miscellaneous subjects (non-engineering) are zero.

A NEW SCHOOL OF ENGINEERING.

BY J. C. L. FISH.

Professor of Civil Engineering at Stanford University

Uniting its departments of engineering, Stanford University has recently formed a School of Engineering. Some years must elapse, of course, before a new institution can be judged by its product; but the reader who from any angle has occasion to consider engineering education, may be interested in the plan of organization of this school and in its curriculum leading to the degree of "A.B. in Engineering," or at least in the ideas from which the plan and the curriculum were developed.

In October, 1924, President Wilbur appointed a committee of seven,* drawn from the existing departments of engineering, to consider engineering education and the question of creating a school of engineering. The committee drew up as a basis for a plan of organization of such school the following.

Principles of Organization.

The School of Engineering should be so organized as to

1. Exemplify and emphasize to all, both within and without the school,
   - (*a*) the fact that the same general methods and the same general body of fundamentals are used by all engineers in their problems, and
   - (*b*) the essential solidarity of all engineers—their community of interests, feelings and actions—

   and thus strengthen the esprit de corps; and at the same time
2. Recognize fully the necessity for differentiated professional training in the application of methods and principles, drawn from the same common funds, to accord with the important differences in conditions and requirements between the several fields or branches of engineering;

* H. W. Stebbins (Chairman), W. J. Crook, J. C. L. Fish, H. H. Henline, E. P. Lesley, R. E. Swain, E. C. Thomas.

3. Ensure that the undergraduate curriculum at all times will reflect the consensus of opinion of the majority of the members of the engineering faculty in regard to depth, breadth, and liberality;
4. Create and maintain in each and every member of the engineering faculty an active interest in problems of engineering education, by placing upon his shoulders specific responsibilities in connection with such problems;
5. Promote the fullest coördination among the various units of the School; and
6. Assure harmonious and concerted action in the School's external relations.

The efforts of the committee to devise an organization in conformity with the principles set forth above, resulted in the following plan.

PLAN OF ORGANIZATION.

1. The School of Engineering (*a*) shall include as integral parts of its structure the existing Engineering Departments and such other Engineering Departments as from time to time may be set up in the School by the Board of Trustees; (*b*) shall have a single executive head, called "Dean," appointed in the manner now or hereafter provided for in the case of appointments proceeding from the President's Office; and (*c*) shall bear the same relation to the University as the non-engineering Departments.

2. The Faculty of each component Department of Engineering shall function in the manner prescribed for the faculties of non-engineering departments except as otherwise provided in this Plan of Organization.

3. The Faculty of the School of Engineering shall consist of the Dean and all members of the Faculties of the component Engineering Departments; but only members who are members of the Academic Council shall have the right to vote. The Faculty of the School shall control the curricula thereof, both undergraduate and graduate, subject only to such control as is vested in the Board of Trustees, the President or the Academic Council.

4. The Dean shall preside at the meetings of the Faculty of the School, and shall act as the representative of the School and of each part thereof in its official relations with the President, the Academic Council and the non-engineering departments. He shall countersign all requisitions originat-

ing in the component departments, and sign all other requisitions issuing from the School.

5. Among the Standing Committees of the School of Engineering shall be the following:

Executive Committee,
Curriculum Committee,
Registration Committee,
Schedule Committee,
Publication Committee.

6. The Executive Committee shall consist of the Executive Heads of the Component Engineering Departments.

7. Each of the other Standing Committees shall be composed of members of the Faculty of the School, one member from each component Engineering Department, appointed annually by the Executive Head of the Department; provided that no member of a Department shall serve on more than one Standing Committee at one time, except is so far as may be necessary in a Department of which the number of members is less than the number of Standing Committees.

8. Each Standing Committee shall annually elect a Chairman and a Secretary from its membership.

9. The Standing Committees on Curriculum, Registration, Schedule, and Publication shall have the duty under the Dean of carrying out the general policies adopted by the Faculty of the School for their respective fields.

10. The Executive Committee shall function in the School of Engineering as the Advisory Board functions in the University, functioning between the Dean and the President as the Advisory Board functions between the President and the Board of Trustees; and the Executive Committee shall function similarly in connection with the Dean's recommendations for annual and special appropriations. The Executive Committee shall also make recommendations to the Dean regarding—

(*a*) The distribution, among the Departments, of annual and special appropriations made to the School by the Trustees or by the President.

(*b*) The Distribution of personnel, of study subjects, and of facilities among the Departments; and

(*c*) General methods of instruction.

11. The Executive Committee shall consider any other question that may be submitted to it by the Dean, and report to the Dean its recommendations thereon.

12. All communications between the Dean and any Committee shall be in writing.

13. Minutes of meetings of all Standing Committees shall be kept by their respective Secretaries, and filed with the Dean.

14. The Faculty of the School shall meet regularly once a quarter at such time as it shall determine, and otherwise at the call of the Dean or of any five members.

15. The Dean shall annually appoint from its membership the Secretary of the Faculty of the School.

As a guide to planning an undergraduate curriculum the President's committee formulated the following:

BASIC IDEAS FOR A FOUR-YEAR UNDERGRADUATE CURRICULUM IN ENGINEERING.

1. The curriculum should be practicable.

2. The curriculum should include all fundamental principles that comprehensive engineering problems require for their solution.

3. The curriculum should include the application of fundamental principles to the solution of minor and major engineering problems.

4. The curriculum should include such studies as will, together with the studies of high school and grammar school, give the student the widest experience among the different departments of knowledge to broaden his outlook, stimulate his interests, disclose the range of his aptitudes, and discover those lines of effort for which he is best fitted.

5. The curriculum should include the field, laboratory, and office technic of measuring, recording and combining the physical data of engineering problems, and the technic of giving effective expression, in office, field, and laboratory, to the solution of engineering problems.

6. The curriculum should call into play the initiative and the judgment of the student in the important matter of revising, from time to time as data from his experience accumulate, the plans for his immediate and distant future.

Experience proves that a four-year curriculum cannot fully satisfy the six ideas described above, and we are forced to one or another of the following three alternatives:

A. Extend the curriculum to five or more years; or

B. Ignore entirely one or more of the six ideals, as may be necessary to confine the curriculum to four years; or

C. Plan a four-year curriculum which shall sacrifice partially each and every one of the six ideals.

Alternative *A* must be rejected, because it would be unfair to the engineering student to require more time for the A.B. degree in Engineering than for the A.B. degree in other branches of learning.

Alternative *B* must be rejected, because every one of the six ideals is of high importance, and the ideal of highest does not overshadow the ideal of lowest importance to such an extent as to warrant entirely ignoring the latter in order to recognize to the full the former.

Alternative *C* is therefore to be adopted.

This committee therefore adopts the plan of making a four-year curriculum which shall partially satisfy each of the six ideals set forth above.

Now arises the question, Shall all the ideals be sacrificed to the same extent, or shall some be sacrificed more and some less?

The correct answer to this question is indicated by the four facts known from experience, as follows:

a. Fundamentals—organized bodies of principles—can be mastered with less cost of time and effort in school than in practice; indeed, can be mastered in practice only slowly and with great difficulty.

b. The application of principles to engineering problems can, after some training therein in school, be learned in practice about as readily as in school.

c. The myriad facts and customs of practice are learned rapidly and without conscious effort in practice, but only slowly and with great and tedious effort in school.

d. Real skill in technic of instruments and methods cannot be imparted in school, except to the unusual student.

The President's Committee drew up a four-year general engineering curriculum for the degree of A.B. in Engineering, to accord with the foregoing basic ideas. The chief characteristics of this curriculum are three: (1) free electives and restricted electives together total about two-ninths of the four year's work; (2) required subjects cover a wide range; (3) required subjects include the core of fundamentals (including mechanics of materials and hydraulics) found in almost all four-year engineering curricula.

The President's Committee recommended that two years of graduate study be required for the degree of Engineer in any Department.

The University created the School in June, giving it the plan of organization stated above, and publishing the following:

SCHOOL OF ENGINEERING.

The School of Engineering has been organized to include the existing engineering departments and such other engineering departments as may be hereafter established. The Faculty of the School consists of the Dean and all members of the component engineering departments. The purpose of the School is to provide a four-year curriculum leading to the degree of Bachelor of Arts in Engineering, and a two-year graduate curriculum leading to the degree of Engineer. For the present at least the four-year undergraduate curricula in the various component departments of the School may be continued and candidates may be recommended for the A.B. degree by the several department faculties.

The Faculty of the School, on recommendation of its Curriculum Committee, authorized the Dean to begin, in January, 1926, the enrollment of students for the degree of A.B. in Engineering, and to use as a basis for such enrollment the curriculum characterized above, pending further study by the Curriculum Committee and corresponding action by the Faculty. It is expected that the work of the Curriculum Committee will enable the Faculty to adopt a revised curriculum for the degree of A.B. in Engineering in time for publication in May.

The drafting of two-year graduate curricula leading to the degree of Engineer in the Departments of the School has not been completed.

At present the School of Engineering comprises these departments: Engineering Mathematics, Civil Engineering, Electrical Engineering, Mechanical Engineering, and Mining and Metallurgy, under the respective executive headships of H. C. Moreno, C. B. Wing, H. J. Ryan, E. P. Lesley, and T. J. Hoover. Of the School of Engineering, T. J. Hoover is Dean and Chas. Moser is Secretary.

SEMINAR IN THE SMALL ENGINEERING SCHOOL.

BY J. H. POUND,

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For the past ten years the engineering faculty at Rice Institute has been wrestling with the problem of developing a generally satisfactory plan for operating an undergraduate seminar. Each year the old system has been critically examined, often with the help of students' suggestions; and each year the results of these conferences have been embodied in new variations to be tried out the next year. The present system has been in use in its essentials for several years and promises to remain fairly stable for some time. It possesses a few features which apparently are not in general use. This description is written in the hope that some of these ideas may prove of service to others.

Many features of the Rice system will not receive commendation from every teacher. Ten years of periodic discussion of these rules has convinced the writer that few, if any, courses in the engineering curriculum can provoke as much disagreement among the faculty as this seminar course. The purposes served by it may be so many, the relative emphasis placed on the several aims finally adopted allows so many combinations, and the variety of methods available for securing these ends is so great that no system can hope to satisfy a very large proportion of teachers. In an engineering faculty of a dozen men or so, probably no one will be entirely satisfied with the method finally adopted. Even the use of the name seminar will be attacked, although the other titles given such courses,—Technical Literature, Engineering Colloquium, Magazine Digest, and the like,—seem to be too narrow in many cases. A survey of university catalogs shows seminar to be much the most popular name, whether it be properly applied or not.

Criticism will be made at once of the fundamental decision that the seminar should contain students of all branches of engineering, although the small school is almost forced by practical considerations to use the general seminar instead of the departmental type. Occasionally the mechanical engineering department will have an unusually small number of senior students, and perhaps the next year the electrical engineering department will experience a lean enrollment. All departments have these occasional slumps. This condition tends to load severely the few students in the departmental seminar unless the meetings come infrequently, which practice diminishes the momentum of the work and its interest to the student. The faculties of schools where branches of national engineering societies are struggling along with small numbers of student members will understand this difficulty very clearly. On the other hand, the general seminar containing twenty or thirty senior students from all departments can meet for a couple of hours once a week without either overloading the students or allowing them to slack off considerably between appearances before the class.

The small groups of students in the departmental seminar admittedly allow the use of more technical language, the discussion of special subjects not understood by students in other departments, closer faculty criticism of papers presented, and perhaps more sustained interest from the student, though the latter point is disputed. The fact that a student specializes in civil engineering certainly does not preclude his interest in a properly selected mechanical or electrical engineering subject, and vice versa.

In practice, there has certainly been little difficulty in securing for the general seminar at Rice subjects which are understood by engineers of all kinds of training and yet not so elementary as to lack interest to most of the audience. Engineering problems of immediate and national importance, with political and economic bearings, are especially attractive subjects for the general seminar. Those schools in particular whose engineering curriculums do not encourage specialization

before the Junior year need have little trouble finding subjects which are interesting and yet not too deep for the general seminar. By using such subjects, these schools will be continuing to apply the principles of emphasizing fundamentals and of giving each student to some degree a knowledge of the problems faced by other kinds of engineers.

One may also argue whether discussing special topics in a special technical language in a departmental seminar is as good exercise for the student as discussing subjects of more general interest in terms which must be deliberately selected to suit a mixed and relatively non-technical audience. This latter situation is, of course, one which the engineering graduate is likely to meet in practice. Whenever this last point is brought up, the writer is always reminded of the story of the young engineer who, after addressing the councilmen of a small municipality regarding the purchase of electrical equipment, was asked where the town could buy the good power-factor he had said was so necessary.

It is evident that in selecting between the general and the departmental seminars most of the arguments applying to a general or a highly specialized curriculum can be applied. The large school can use the departmental seminar if it wishes, and its policy regarding specialization in general will affect its decision; but the small school will find it hard to specialze in seminar even if it so desires. Perhaps the ideal arrangement would be to operate both general and departmental seminars, but the time required for this plan would oppose its application.

Still another point on which practice can vary widely is the extent to which emphasis is put upon the formal composition of the student's paper. In some schools the paper is written out complete, criticized by an adviser, revised, and read verbatum before the class. At the other extreme, the student delivers his paper as nearly as possible without notes, perhaps following an outline and using sources which have received faculty approval. The first method allows closer faculty criticism and control, especially over the student's

English, but a somewhat similar control over the English at least already exists through the student's written laboratory reports. Is it essential that much of the energy put into seminar be used in written composition? Many teachers seem to think this practice not even desirable.

On examining the other method, we find that training in delivering a paper from brief notes has several advantages, all of them very apparent. When such a presentation is well done, it is likely to be more interesting and effective than reading, but an easy delivery requires practice. This practice not only rubs in the information the student has collected, but (more important in the long run) it exposes undesirable habits and gives him an opportunity to develop his ability to speak effectively and confidently, standing on his feet and facing an audience. This practice he should secure before its lack proves serious to him, and in no place can the average student get it as well as in a faculty controlled seminar. Ordinary class-room recitations will not give it; and even when the student engineering societies are addressed by their own student members (and the Rice men very much prefer speakers from off the campus), the most energetic students can secure this practice in very limited quantities. Many students will not accept even these opportunities willingly, and unless credit toward a degree is given for student society work, some students cannot be forced to take any active part whatever. Moreover, faculty control of the subjects selected for discussion and faculty criticism of the speeches made cannot be very strict in the student society unless such work is required for graduation.

These considerations have led to the use at Rice of a faculty-controlled general seminar in addition to the independent student-controlled engineering society, and in this seminar they have led to the use of speeches based on brief approved outlines instead of on finished compositions. The actual delivery of the paper is as free from dependance on notes as the student dares to make it. His grade on delivery depends on the effect he produces rather than on the extent of his use of notes, although he is urged to try to be independent of such help.

Still another moot point is whether a student should select his subject or have it assigned to him. The use of both methods in turn seems attractive. During the first semester, while the student is learning the resources of the library and becoming familiar with the requirements of the course, assigning subjects to him lightens his work and suggests by example the type of subjects suited to use in a general seminar. It also allows the instructor to secure a discussion of subjects of general interest,—say engineering history or biography,—with no place in other courses or to elaborate indirectly information given incompletely in another course. Later in the year, perhaps during the second semester, requiring the student to do at least a part of the selecting of his subjects will extend his reading and aid in maintaining his interest. A practice which has proved satisfactory requires him to keep on file during the second semester a list of at least three subjects approved by the head of his department, any one of which he will prepare and deliver on two weeks notice from the instructor in charge of seminar.

The chief difficulty experienced with undergraduate seminars of any sort seems to be that of maintaining interest in it. As in many other fields, the intensity of a man's interest in seminar seems to be related directly to his personal activity in it. To keep him interested requires getting him to appear on the floor rather frequently, but a two or three hour period once a week does not permit formal speeches from more than about three students a week. Moreover, these infrequent appearances mean a correspondingly small amount of reading of technical publications, and in this reading one meets at last a major purpose of engineering seminar recognized by every school which uses the course at all. Perhaps it is the *only* common ground on which the various systems meet. Certainly it is an important function to keep operating regularly.

To secure these two ends of frequent appearance and regular reading, brief formal discussion of papers is required by the Rice faculty. In general, the seminar meetings are held in the manner of an engineering society meeting, presided over

by students selected in rotation to act as chairman,—another method of securing more frequent appearances of students before an audience. Just before the meeting each student must turn over to the chairman 3 inch by 5 inch index cards containing descriptions of three pieces of information connected with some or all of the three speeches normally scheduled for the meeting. All three discussion items may refer to one speech or they may be scattered among the three subjects in any way desired. These items must be secured from reading or from practical experience or from personal investigation. That they are really related to the speaker's subject is determined by consulting the speaker's outline, which is prepared with the advice of a specified faculty man and is posted on a bulletin board a week in advance of the date of the speech.

After consulting the outlines and the discussion cards, the chairman selects those discussion subjects which he considers best suited to an interesting elaboration of the speech, and after the speaker has made his address and has answered many questions asked him from the floor, the chairman calls on the proper students in turn for this formal discussion, which is given by the student on his feet in his place in the audience. Usually only a minute or two is required to deliver one item, and ordinarily it consists simply of additional information on the speaker's subject. Occasionally, however, adverse data or opinions are presented and a very real discussion ensues. It is true that some pressure from the faculty is required to secure three satisfactory discussion subjects per man per meeting, but the net results of this discussion system are a very gratifying amount of reading and over a dozen men taking an active part in each meeting instead of just the three or four chief speakers.

After the formal discussion is over, the chairman invites voluntary discussion from students and faculty before introducing the next speaker. The faculty, sitting in the rear of of the audience, grade each speaker and each man presenting formal discussion but not men offering voluntary discussion. These grades are averaged by the instructor in charge of

seminar and the final grades are sent to the speakers. The faculty men also include in their grade records both favorable and adverse comments on the student's material, arrangement of material, English, and delivery. These comments are posted promptly for the information of all students. Similar comments are sometimes made orally in class.

The responsibility for the course and the clerical work involved in it is passed to a different instructor in turn each semester. All engineering teachers not holding classes at the hours of seminar are expected to attend this class frequently and to submit grades and comments. In practice about half of them attend a given meeting. Securing grades from several instructors not only seems to get somewhat fairer grades but seems to increase faculty interest in the course,—and sometimes an instructor needs stimulation as much as any student does!

To prevent any real or alleged misunderstanding of the machinery of the course, a set of instructions in mimeographed form is given each student at the beginning of the year. These instructions would probably be too long for reproduction here, but in brief they cover:

1. The purposes of engineering seminar,—to encourage the habit of technical reading, to instruct in the sources of up-to-date information, to instruct in logical and pleasing arrangement of data or reasoning, to develop the ability to address an audience, and to secure a certain amount of engineering information.

2. Instructions for preparing speeches,—character of subjects desired, faculty revision and approval of outline, quantity of material (about twenty minutes to deliver), sources (reliable technical periodicals preferred), and the importance of practice before delivery of speech. Extracts from A. S. M. E. and A. I. E. E. advice to speakers are included.

3. Instructions for formal discussion.

4. Instructions for the conduct of meetings. Duties of student chairman.

5. Instructions for selecting and reporting preferred subjects for second semester work.

Copies of these instructions, which contain a good many mechanical suggestions intended to smooth out the operation of the course, will be furnished gladly to individual teachers requesting it. But perhaps one of these precautions deserves to be mentioned. Since the time required to deliver speeches and discussion varies from meeting to meeting, there can be no very definite hour for dismissing the seminar. It is very desirable that plenty of time be allowed in the schedule. A very good arrangement allots all of one afternoon to seminar, although the class is usually over long before the hour for athletic practice or games.

The credit for working up this system of instruction cannot be given to any one teacher and certainly not to the writer. It has been a coöperative task resulting in what seems to the designers to be a fairly efficient machine for giving a valuable piece of instruction to relatively small numbers of students.

THE FRESHMAN ENGINEERING PROBLEMS COURSE.

BY B. B. BESSESEN,

Instructor in Electrical Engineering, Oregon Agricultural College.

The necessity for an engineering problems course to hold the interest of the freshmen in our schools has been felt by educators for a long time. Some have already taken, and others are taking steps toward organizing a course which will hold the freshmen's attention, and at the same time give them a survey of the field of engineering. The interest shown in recent papers on this problem, such as Professor White's "The Freshmen," Professor Dana's "The Comparison of Engineering Problems Courses," and others, has impelled me to offer a brief résumé of our experience with the hope that it may be of some use to other engineerinng schools.

The course we have here for freshmen is an outgrowth of study and training given to the Student Army Training Corps during the war, though the need given had been felt previous to that time. The actual application of a regular freshman engineering problems course in each department was made part of the curricula beginning with the school year of 1919–1920. The matter of administration and subject-matter was left to each department. The mechanical and electrical departments both organized a three-credit lecture, recitation, and laboratory course for each of the three terms, while the civil engineering department organized a one third credit lecture course of a more general nature for each of the three terms. The total work in the electrical and mechanical departments amounted to about one fifth of the first year's course. Supplementing this there was also a lecture course given for two terms of one half credit per term for electrical and mechanical engineering students. For this subject, local engineering problems were discussed by the Dean of the School of Engineering, moving pictures of construction, manufacturing, or other engineering operations were shown, or

prominent men of the engineering field were scheduled to talk to the students on related subjects. General lectures on unrelated subjects, as forestry, personal hygiene, how to study, looking for a position, and other topics were discussed by the deans or representatives of the other schools or departments of the institution.

The three-credit course in mechanical engineering was discontinued after three years, and in place of it the regular freshman engineering course as given in most colleges was substituted. This includes mathematics, chemistry, English, drawing, shopwork, and military science. No changes have been made in the civil engineering course in point of credits or nature of the course. The electrical course for freshmen has evolved quite completely, though the credits are unchanged.

The writer has charge of all freshman work in electrical engineering, and, having spent several years in practical engineering work, feels that the student needs such ideas as will best acquaint him with actual conditions he must necessarily meet when he leaves school, whatever his vocation may be.

The course gives the students certain fundamental ideas, namely:

(*a*) Some conception of neatness, form, and organization of material.

(*b*) The proper method of how to study or to work more effectively.

I believe the most a student can possibly be expected to get in the freshman problems course is a better understanding of how to organize his material for presentation and study, with the result that he will be better able to choose the course most suited to him. The student can, however, get a considerable amount of the subject-matter, as, for example, a detailed knowledge of electricity and the laws governing it.

The natural tendency in this kind of course is to stress a greater proportionate share of the special subject-matter in which the instructor or student, or both, may be especially interested, rather than to practice some of the less interesting

but more fundamental prerequisites that count for success in a profession, particularly engineering. I refer to mathematics and physics and English, although the two former subjects always have a regular place in all engineering curricula.

The problems course used by the electrical department requires the ordinary high school algebra, but can be much more successfully handled if the student is also studying regular college mathematics and physics. The course is divided equally into recitation and laboratory periods, each of which parallels the other. The recitations, two one-hour periods each week, cover written problems, which are prepared in advance, and class discussion. Direct current electricity is studied during the first term, and alternating current during the second and third terms. The second term covers single-phase circuits and the third term polyphase circuits. We use Swoope's "Lessons in Practical Electricity" as a text during the first term and Timbie and Higbie's "Essentials of Alternating Currents" during the second and third terms.

For the subject of direct currents, a study is made of the hydraulic analogy of electric pressure and current, series and parallel circuits, Ohm's Law, and the effect of heating in an electric circuit. Practical problems are solved to differentiate between the different kinds of direct current motors and generators. The study of voltage transformers, magnetism, induction, and power factor are taken up with the beginning of the second term. A thorough drill on the relation of current and voltage to each other is made by vector diagrams. This drill continues throughout the third term in conjunction with the study of the different three-phase combinations for transformers and other electrical machines. We have often been asked how we can accomplish anything in alternating currents, particularly the study of three-phase circuits. We do not aim to study polyphase circuits further than to find their advantages and a general idea of their characteristics. The aim is to give the student a course complete in itself, so that he can actually have something at the end of the year which he can use immediately, either in the field or for further study.

As the laboratory work which covers the more practical side of the course proves more interesting, the students gain a better understanding of the subject by this method of attack than by recitation. A less interesting phase of this work is however the writing up of the experiment itself. There is always a tendency to leave out the theoretical part of the discussion, and even good English in the reports. One of the first things I am forced to check up on is their grammar, sentence structure, paragraphing, and spelling. I find even after specific written instructions are given in their syllabus of experiments, supplemented by an explanation of the form of the report at the first meeting of the class, and by a display of sample reports or write-ups, that the first attempts cover the whole range of the scale from poor work to good work. Each student's problem is studied separately and improvements are suggested. The first two or three reports are turned back regularly until the student has mastered the general idea and is making a real conscientious effort.

The students perform tests on simple experiments in the same manner as the upper classemen do, but do it more as individual work. Although the experimental data necessary are usually few, the students are required to devise methods of checking them before the test is considered complete. They are also given much drill in the wiring up of circuits. To do this, they are required first to have studied the subject and then to draw a wiring diagram, for presentation at the beginning of the period, of just how the meters and other apparatus are to be connected. They are also required to state the object of the test, what data they will require for this, and just how they are to get them. The details are considered in a general discussion for about half an hour just before the experiment. As the students work in groups of two or three, detailed points are studied and explained individually as they come up.

Close supervision is maintained during the experimental measurements in order that all students may receive good data. The students are left to their own resources as far as possible for devising methods of checking their results. Each group

performs the experiment independently. The personnel of the groups is chosen so that all members of a given group are of almost equal ability. They are assigned accordingly for the term. This tends to cause each student to feel his own responsibility and necessarily to watch more closely all parts of the experiment.

We have one of these experiments each week of the three terms of the first year. After each experiment is completed and checked, the student is free to write it up as a report, which is to be turned in at the beginning of the next regular laboratory period one week later.

TABLE I.

OREGON AGRICULTURAL COLLEGE.

Students Registered and Graduating in the School of Engineering.

School Year.	Mechanical Engineering.					Civil Engineering.					Electrical Engineering.				
	Fresh.	Soph.	Junior.	Senior.	No. Grad.	Fresh.	Soph.	Junior.	Senior.	No. Grad.	Fresh.	Soph.	Junior.	Senior.	No. Grad.
14–15.....	29	16	21	7	8	9	10	14	12	12	22	15	14	12	10
15–16.....	27	16	10	17	14	8	5	7	13	13	19	21	10	12	9
16–17.....	20	21	14	11	12	19	14	6	7	4	35	14	16	11	7
17–18.....	51	17	11	16	12	15	14	7	2	2	40	24	6	13	8
18–19.....	277	50	11	6	6	73	14	3	7	5	115	15	10	7	6
19–20.....	128	63	32	6	3	87	48	19	4	4	135	40	16	10	7
20–21.....	69	82	40	21	19	47	52	36	18	12	99	87	28	13	10
21–22.....	67	58	51	33	25	40	38	46	25	25	107	77	63	21	16
22–23.....	68	39	44	45	45	54	25	25	25	23	123	75	56	43	42
23–24.....	48	39	36	28	30	52	34	29	20	23	142	72	52	41	40

These reports are intended to contain the essentials of any good engineering report; that is, they follow good form of which the student is given some special instruction. The form outline is not intended to take any initiative away from the student but at this stage of his course he hardly knows what an engineering report is. In the makeup of the report, the student is required to use standard $8\frac{1}{2}'' \times 11''$ paper. The report is made up and fastened in a manila folder.

The report averages about one and a half typewritten pages, and may be penwritten or typewritten. Included with the report is a sheet of tabulated data and results, a sheet for wiring diagram made up according to conventional standards, a curve sheet, if there is one, and the sheet of original notes.

Originally these reports were made up during the class period in a note book without much reference study or regard to form. Later it was thought that the students would have enough pride in the work to make up the reports as the upperclassmen do, even though the experiments are less comprehensive. The added interest they take in this work bears out the statement. The main benefit of the report writing is to give the student time to reflect on the subject, and to look up references. Usually, not being near some one who can answer his questions easily, the student must give his closest attention to explanations and phenomena of the experiment itself. Quite often he is also required to make a further study of the text or other ready reference material to explain questions asked in the review, or peculiarities observed in the experiment.

The thought has occurred that the course may be too difficult for the student, and that it tends to drive some of them away, but, according to Table II, in the last three years the electrical department has had as many as, or more than the other two departments combined. According to Table III, practically the same per cent. have graduated as before the course was organized, but one direct result is that most transfers that are effected occur early in the first year rather than in the second or third year, to the mutual advantage of the student and department concerned. Mortality curves indicating the average decrease of student registration for each department are shown.

The mortality curves show a smoothing-out process with the problems course, particularly in electrical and mechanical engineering. The data for the curves are from the official figures of the registrar. These curves are drawn from averages made up over their respective periods. The curves show the actual

registration in per cent. of the original registration for the class concerned for each year in college. The period indicated by these curves covers four years just before the World War, when no engineering problems were used, and four years just following the war, when the engineering problems were used. The school year of 1918–1919 was omitted because of the irregular registration caused by the war conditions. These curves were begun with the school year of 1914–1915, because of a regulation just then effective that entering freshmen must be high school graduates. In general the curves seem to show that even though the same per cent. of students who enter graduate, a larger per cent. change their course the first year. In other words, the engineering problems course helps them find themselves earlier in the course instead of dropping out of it at a later date, and even out of the institution itself. It is not claimed that the curves are an absolutely true guide, but

TABLE II.

OREGON AGRICULTURAL COLLEGE.

Figures show Student Mortality in the School of Engineering by Classes.

No engineering problems course given to freshmen.

Class.	Mechanical Engineering.				Civil Engineering.				Electrical Engineering.			
	Fresh.	Soph.	Junior.	Senior.	Fresh.	Soph.	Junior.	Senior.	Fresh.	Soph.	Junior.	Senior.
1918	29	16	14	16	9	5	6	2	22	21	16	13
1919	27	21	11	6	8	14	7	7	19	14	6	7
1920	20	17	11	6	19	14	3	4	35	24	10	10
1921	51	50	32	21	15	14	19	18	40	15	16	13
Engineering problems course given to freshmen.												
1923	128	82	51	45	87	52	46	25	135	87	63	43
1924	69	58	44	28	47	38	25	20	99	77	56	41
1925	67	39	36		40	25	29		107	75	52	
1926	68	39			54	34			123	72		
1927	48				52				142			

the general trend seems to be quite definite. The period covered is relatively brief, and, too, changes in regulations and in the method of bookkeeping by the registration office will no doubt cause some curve variation.

TABLE III.

OREGON AGRICULTURAL COLLEGE.

Per Cent. Student Mortality in the School of Engineering by Classes.
No engineering problems course given to freshmen.

Class.	Mechanical Engineering.				Civil Engineering.				Electrical Engineering.			
	Fresh.	Soph.	Junior.	Senior.	Fresh.	Soph.	Junior.	Senior.	Fresh.	Soph.	Junior.	Senior.
1918.....	100	55.2	48.3	55.2	100	55.5	66.6	22.2	100	95.5	72.7	59.1
1919.....	100	77.8	40.7	22.2	100	175.0	87.5	87.5	100	73.6	31.6	36.8
1920.....	100	85.0	55.0	30.0	100	73.7	15.8	21.5	100	68.6	28.5	28.5
1921.....	100	98.0	62.7	41.2	100	93.3	126.7	120.0	100	37.5	40.0	32.5
Ave.....	100	79.0	51.7	37.2	100	99.4	74.2	62.8	100	68.8	43.2	39.2
Engineering problems course given to freshmen.												
1923.....	100	64.0	39.8	35.1	100	59.8	52.9	28.8	100	64.5	46.7	31.9
1924.....	100	84.0	63.8	40.6	100	80.9	53.2	42.5	100	77.8	56.5	41.4
1925.....	100	58.2	53.7		100	62.5	72.5		100	70.1	48.6	
1926.....	100	57.4			100	63.0			100	58.5		
1927.....	100				100				100			
Ave.....	100	65.9	52.4	37.8	100	66.6	59.5	35.7	100	67.7	50.6	36.7

I have gone into our electrical course for freshmen in some detail, because it covers the general subject-matter more completely than the other engineering problem courses here have.

From a study of college catalogs and from correspondence regarding electrical work for freshmen in other institutions over the country, it would appear that we cover the subject very completely the first year.

The engineering school plans to change the course for freshmen next year, so that all will receive the same kind of drill.

The purpose is to make the course equally strong in each department in order that a student may be better able to make his choice of department for further study according to his particular aptitude.

The engineering school is also making a study of the special aptitudes of the beginning students in mathematics and chemistry. If this study seems worth while, as every indication shows it is, English and physics may also be used. Supplementing these there is given a general intelligence test, a study of which it is hoped will help the student to find his niche, whatever the field may be. The questions pertaining to the above tests are those published and recommended by the National Research Council. In using these standard tests, a score can be obtained in terms of general standards.

Summing up the conclusions then, it would seem that first, there should be chosen simple and actual engineering problems with whatever detail desirable. Second, the problem should be handled with particular consideration for fundamentals, as English, mathematics, and physics. Third, care should be exercised that the object of the course is not overlooked, and too much subject-matter put in. Fourth, a detailed study should be made of each individual in order to help him become more suitably placed, whether it is in the engineering school or some other school, or directly in industry. With the above responsibilities in mind, the teaching of freshmen becomes a real problem, and, considering the detail the instructor must know his subject so thoroughly that he can give simple and direct analogies and draw conclusion for the students of all problems likely to come up.

THE ENGLISH DEPARTMENT.

THE PROPOSED CONFERENCE OF ENGLISH AT THE IOWA CITY MEETING.

The Committee on English will have one session at the annual meeting of the S. P. E. E. To this conference it invites all Deans, Heads of Departments, and all others vitally concerned with the problem of English for engineering and technical students. There has developed, in the Middle West especially, a rather coherent group of teachers in English, who have identified themselves with engineering education and who regard their teaching of engineering students as pioneer service in this important field. Iowa City is so centrally located, that the prospects are bright for bringing together a larger number than usual of such teachers of English. The joint conference should, therefore, result in some illuminaiting and profitable discussions.

In choosing for this conference a subject in which both the teachers of English and the Deans will be equally interested the Committee has kept in mind the two-fold purpose of English as a part of the education of the engineering student. It must aim, first, to secure the natural and habitual use of correct English, and to develop facility in expression. It must also give the student a love and intelligent appreciation of books. Since it has been quite generally agreed that our students will find their professional careers definitely affected by their ability to write and speak correctly and effectively, the Committee has for the past year definitely emphasized the need for more whole-hearted and intelligent coöperation between the teachers of English and the rest of the faculty. Habits cannot be "taught," they must be established by the united efforts of all who have any contact with the student or who contribute to his training.

The Committee has long been eager to attack the second part of its problem. It has risked being misunderstood, being

thought to place more importance on English Composition than on English Literature as a means of education. For the conference at Iowa City, therefore, it has agreed to open up the discussion of courses in literature for engineering students. Since in most curricula such courses must be taken as electives beyond the required Freshman course in Composition, the subject is announced as *Elective courses in English for Engineering Students.*

This subject suggests the consideration of the importance to the student of free election as an educational experience, the problem of how to allow time for such election and of the type of elective that will be sufficiently attractive to appeal to a student with a definitely prescribed interest. The Chairman of the English Committee, who has been engaged for nearly twenty years in the administration of such courses at the University of Michigan will present the subject, but he appeals to all who may be able to contribute, to write him as to the situations which obtain in their respective schools in this matter of elective courses in English. He is especially anxious to obtain information on the following questions:

1. What courses in English are available as electives to the students in your college?
2. What opportunity have they to elect such courses?
3. What proportion of them do actually elect such courses?
4. Are such elections largely in the courses in English Literature or in English Composition?

Address communications to J. Raleigh Nelson, 927 Forrest Ave., Ann Arbor, Michigan.

SECTIONS AND BRANCHES.

The first meeting of the **Colorado Branch** for this school year was held on October 21, 1925, in one of the engineering buildings. The meeting was primarily a "get-acquainted" party for the faculty and their families, lasting from four until six-thirty o'clock in the afternoon. Refreshments were served and means of entertainment provided. The president of the University, Dr. George Norlin, and Mrs. Norlin were among the guests.

The second meeting of the faculty was held on January 28, in the main engineering building. A dinner was served by a committee of the faculty in the engineering laboratories. The meal was followed by an address by Dr. L. Thomas Hopkins, of the Department of Education, on "Problems Relating to Freshman Education."

Mr. Hopkins stressed particularly the relationship between the institutions of higher learning and the secondary schools. He pointed out that up to fifteen years ago the high schools did most of the selecting of students for college, but that now the burden of selection is upon the universities. He explained that formerly the high school curriculum was rigid, emphasizing courses that prepared students for college; but that in the last decade the high school curriculum has changed radically. Greater freedom is allowed students in selecting courses, and the emphasis is on giving as many as possible a liberal education, and on making education practical, so that the student will be prepared to meet the problems of the economic world, whether he goes to college or not. Contemporary with this change, institutions of higher learning have also changed their attitude, and are endeavoring to give an education to as many as possible. As a result, the enrollment of universities has increased to an unprecedented degree, and their student bodies now consist not only of the upper third of high school graduates (which constituted the larger proportion of college students fifteen years ago), but also the second third, and a

generous part of the lower third. Hence, in the classroom are to be found a great many who are ill-prepared, and some totally unfit, to meet the standards of college curricula. The question arises as to what shall be done with these types of students who make up so large a proportion of the student body. Should they be excluded from the university? Should they receive special attention and training? Should they be permitted to proceed with their education under a reduced schedule?

Mr. Hopkins' talk was so stimulating that the discussion which followed lasted for two hours.

On February 18, the annual winter social party was held. The program consisted of a series of contests, "stunts," and acts presented by various members of the faculty.

Five days later, on February 23, the faculty was the host to Mr. W. E. Wickenden. At noon he was entertained at luncheon by the faculty. In the afternoon he addressed a special convocation of the engineering students in Macky Auditorium. In this talk, Mr. Wickenden outlined some of the work of the S. P. E. E. investigation, and gave interesting statistics, showing that the opportunities for advancement in the engineering profession are unlimited.

In the evening Mr. Wickenden was entertained at a dinner by the faculty. The meal was followed by an address by Mr. Wickenden, who reviewed the findings of the investigation for the promotion of engineering education.

The social activities of the year will be concluded by an outdoor picnic to be held at the Country Club sometime in June.

The committee that has made possible all of the foregoing successful meetings consists of Professors M. S. Coover, F. S. Baur, and C. L. Eckel.

WAINO S. NYLAND,
Secretary.

Minnesota Section.—Forty-six members and guests assembled in Room 204, Minnesota Union, at 6:00 P.M. dinner, to hear Professor W. K. Lewis, of the Massachusetts Institute

of Technology, discuss "Coöperative Engineering Education."

Professor Lewis gave a very interesting and enlightening talk on the scheme they have worked out giving practical experience to students in their senior year at industrial institutions, the students course being similar to the course in interneship given to all graduates of the various medical schools.

A great deal of interest was manifested in Professor Lewis' address and in the discussion following it.

B. J. ROBERTSON,
Secretary.

The Purdue Branch met with the Physics Department on the evening of March 25, for the third meeting of the school year.

A paper was presented by Prof. Ervin S. Ferry, head of the Department of Physics, dealing with the aims and methods of the department in the teaching of general physics to engineering students. During the course of his talk, Prof. Ferry touched upon the matters of text-books, sectioning of students upon the basis of ability, manner of conducting lectures and recitations and the method used by the department staff in making up and grading sets of examination papers. Touching briefly upon the subject of laboratory instruction he emphasized the need for more laboratory work for the poorer students—the class of men who could better visualize and solve problems with apparatus in their hands.

The subject of laboratory instruction and procedure was dealt with at length by Prof. Raymond B. Abbott, in charge of general physics laboratory instruction, who classified all physics laboratory work under three headings: (1) General Physics Laboratory, (2) Precise Physical Measurements, (3) Research.

The purposes of laboratory instruction under these headings were discussed and charts presented showing the hours spent by the various engineering groups in the physics laboratories at Purdue. The advantages in correlating laboratory and class room instruction were pointed out and Prof. Abbott also

strongly urged the need for more semester hours to be spent by the engineering student in fundamental physics instruction, including the laboratory as a parallel or correlated course.

The ensuing discussion was entered into by Dean A. A. Potter, of the Schools of Engineering, Dean Stanley Coulter, of the School of Science, Prof. C. Francis Harding, Head of the School of Electrical Engineering, and others. Director F. D. McClusky, of the Division of Educational Reference, summed up the discussion by an appeal for greater consideration of the prime purposes of teaching; with consequent less attention to the matter of imparting information to the student.

The chairman appointed a committee on nominations to report at the next meeting, scheduled tentatively with the department of Chemistry, and the meeting adjourned at 9:40, attendance 70.

G. C. BLALOCK,
Assistant Professor of Electrical Engineering,
Secretary.

COLLEGE NOTES.

University of Wisconsin.—For the purpose of promoting engineering research and the development of qualified research men, the University of Wisconsin has established three research fellowships in the College of Engineering. These fellowships are granted under the following conditions:

Each fellow will be appointed for a period of two years, subject to satisfactory service. The salary will be $900 for the first year and $1,100 for the second year. The fellow will be required to devote not less than half his time to assigned research work in the College of Engineering, but will in any case be given opportunity to complete his work for the M.S. degree within the two-year period. Candidates must be graduates of engineering colleges of recognized standing, and should preferably have had one or two years' graduate study or teaching or engineering experience. The period of service required will be the usual academic year, including the short vacations. The College of Engineering possesses well-equipped laboratories in which a considerable amount of research work is always under way. Results are published, from time to time, in bulletins of the Engineering Experiment Station. A total of sixty-three bulletins have been published up to the present time.

Applications for these fellowships for the year 1926–27 are now invited. For further information and application blanks, address F. E. Turneaure, Dean, College of Mechanics and Engineering.